Engineering Library

NOV 3 1943

ELECTRICAL REVIEW

FOUNDED 1872

ol. CXXXIII. No. 3437 OCTOBER 8, 1943 6d. WEEKLY

A SIMPLE WAY TO INCREASE WORKS EFFICIENCY

INSTEAD of basing increased output on extension of space, equipment and personnel, industry should seek higher production levels by securing greater efficiency on the part of each worker, and by speeding up the training of those under instruction.

THE VITAL IMPORTANCE OF LIGHTING. Throughout every stage of organised training, from " raw " recruits to skilled hands, lighting plays a vital part in achieving and maintaining full efficiency. Operatives can work better, more quickly, with less personal strain and consequently fewer accidents and " spoils," if they have really good seeing conditions.

A SCIENTIFIC PROBLEM. Good lighting is not simply a matter of increasing the number and power of your lamps. Lighting in industry is a scientific problem, and its correct solution not only increases efficiency, but may save power and therefore fuel. Lighting is a job for the expert.

AN ADVISORY SERVICE WITHOUT OBLIGATION. Principals of factories are invited to make use of the Mazda Industrial Lighting Advisory Service which has been established for their assistance. Without obligation, a lighting specialist will examine and report on present lighting arrangements. He may confirm that they are correct, or be able to make suggestions which will result in increased efficiency, happier workers and higher output. You are invited to write for details.

BTH RESEARCH AIDS INDUSTRY

BTH Research Laboratories have made an intensive study of both the physical and psychological aspects of lighting in wartime industry, and their knowledge and experience are at your free disposal through the

MAZDA

Industrial Lighting Advisory Service

THE BRITISH THOMSON-HOUSTON CO. LTD., CROWN HOUSE, ALDWYCH, LONDON, W.C.2. M.3974

Our Technical Service is available on any matters connected with S.C.A. conductors and related hardware.

THE
British Aluminium
CO. LTD

HEAD OFFICE : OAKLEY MANOR, BELLE VUE, SHREWSBURY, SHROPSHIRE
Telephone : Shrewsbury 4451 Telegrams : Cryolite Shrewsbury

P. 63. E.R. 8.10.43.

ELECTRICAL REVIEW

October 8, 1943

Contents :—

	Page
Editorial—Contracting Industry Wages	457
Electro-Metallurgical Prospects. By H. A. Sieveking, M.Sc.(Eng.), M.Inst.C.E., M.I.E.E.	459
Transformer Restrictions	464
Lighting and Labour. By E. B. Sawyer, F.I.E.S.	465
Electricians' Wages	468
Specialised Laboratory	469
Personal and Social	471
Correspondence	473
Engineering Economics	474
Red Cross Appeal	474

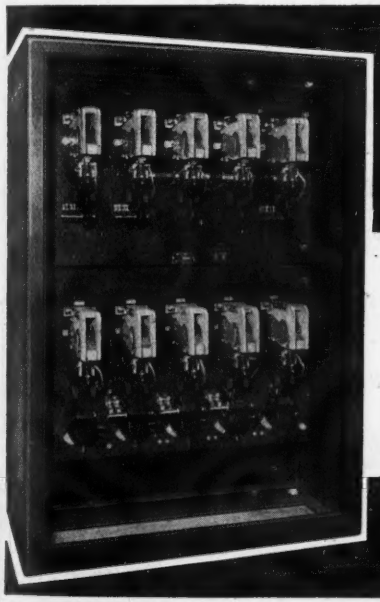
Contents continued :—

	Page
Commerce and Industry	475
War Load in Canada	478
Capacitor Effects. By V. Mayer, A.M.I.E.E.	479
Radio Aerial Systems	481
Electricity Supply	482
Forthcoming Events	483
Financial Section	484
New Patents	489
Contract Information	490
Classified Advertisements	63
Index to Advertisers	74

Managing Editor:
Hugh S. Pocock, M.I.E.E.

Technical Editor: C. O. Brettelle, M.I.E.E.
Commercial Editor: J. H. Cosens

EDITORIAL, ADVERTISING & PUBLISHING OFFICES: Dorset House, Stamford St., London, S.E.1.
Telegraphic Address : "Ageekay, Sedist, London." Code : ABC. Telephone No. : Waterloo 3333 (35 lines).
Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter at the New York, U.S.A., Post Office.
Subscription Rates, Postage free : United Kingdom, £1 14s. 8d. ; Canada, £1 12s. 6d. ; Colonial and Foreign, £1 14s. 8d. per annum.
Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW LTD., and crossed "Lloyds Bank."



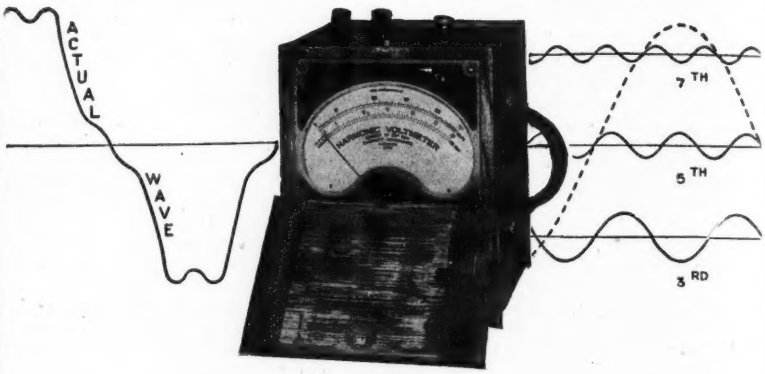
IGRANIC
Electric Control Gear

Equip your electrically driven machines with the "right" control gear — IGRANIC, which will give positive protection to motor and machine and keep them working to secure maximum production.

Illustration shows IGRANIC Contactor Panel for control of Travel motion of 6-ton Slab Charger for Steel Mill.

IGRANIC ELECTRIC Co. LTD.
BEDFORD & LONDON

HARMONIC VOLTMETERS



Not only detect distortion but analyse and measure it.

- A single instrument can be arranged to measure any number of harmonics.
- The sensitivity is such that full scale may correspond to as little as 3 volts of any harmonic.
- Also supplied in graphic form to record either :
  (*a*) The volume of given harmonics or
  (*b*) The presence of distortion due to any harmonic.

Ask for Catalogue Sheet 270

EVERETT EDGCUMBE

Manufacturers of all kinds of indicating and recording electrical instruments. Photometry experts

COLINDALE WORKS, LONDON, N.W.9

Phone: COLINDALE 6045

ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXIII. No. 3437. OCTOBER 8, 1943 6d. WEEKLY

Contracting Industry Wages

An Increase but no Settlement

DETAILS are given on another page of an agreement made between the National Federated Electrical Association and the Electrical Trades Union whereby the payment of the war addition (cost-of-living bonus) paid to operatives in the electrical contracting industry is to be made on an hourly basis instead of weekly. As the change was demanded by the E.T.U. it is obviously expected to operate in the men's favour, and so it will if a full week is worked.

Effect of New Method

The current amount of the weekly addition was 18s. 4d. (i.e., 4·68d. per hour for the standard 47-hour week). The new bonus is to be levelled up to 4¾d. but it is to be included in the calculation of payment for overtime, normally eight hours a week. This at " time and a half " means an addition to wages of 4s. 9d. a week. There is, of course, a reverse side to the shield: if fewer than 47 hours are worked the weekly addition is correspondingly reduced, but nowadays this will rarely happen.

This arrangement has been arrived at after about six months' discussion between the two parties, but it does not settle the main issue. It appears to be merely a sop thrown to the E.T.U. Cerberus to keep it quiet while further negotiations proceed.

The matter originated in a demand at the end of March that the base rates for electricians should be increased by 3d. an hour. This was rejected as unjustifiable by the N.F.E.A. on the ground that the increase in the cost of living, which was one of the arguments adduced in support of the claim, was taken care of by the weekly war addition. Nevertheless, at a later stage of the proceedings the Association made an offer to raise the rates by smaller amounts. For the London zone the increase was to be ½d., it being held that as most London men were now working in the provinces the extra 2d. an hour allowed them as travelling expenses was not being absorbed by such expenses. For the larger provincial centres the increase was to be 1d., and for country areas 1½d. This offer was turned down by the Union.

During the course of the negotiations an " unofficial " strike occurred in the Manchester district; others were threatened in the Midlands and London, but the men were not actually called out.

Resort to Arbitration

Thus the present position is that the Union has gained 4s. 9d. a week for its members, but intends to pursue its earlier claim before an arbitrator and two assessors, the latter being drawn from the building trade with which the electrical contracting industry is most closely concerned. The Union apparently bases its claim on the fact that its members' wages have not risen to the same extent as those paid in other industries. Briefly, the reply of the N.F.E.A. to this is that the wages compare very favourably with those in other trades, the greater increases in their case being due to the fact that from being

unprotected industries they have become "sheltered" by war conditions. These arguments will no doubt be given due weight by the arbitrator and his assistants when they consider the whole question.

Ash and Dust

APART from the obvious undesirability of transporting unburnable matter from the pit-head to the power station, which establishes a *prima facie* case for dealing with the trouble at its source, the presence of dust and ash create more problems for designers of combustion equipment than does anything else. To the operating engineer they represent lower boiler availability, superheat temperature and thermal efficiency. Some offset to the probably higher cost of fuel in the future would be obtained if, in line with the proposals made by Dr. R. Lessing in his Institute of Fuel paper, coal could be delivered to the user with a greatly reduced ash content and of a consistent quality and size.

Coal Separation

DR. LESSING would go further than this. Since coal is a mixture of components with definite characteristics and ash-content composition, he would separate these components on the basis of their differing specific gravities, thus making the most suitable constituents available for any given purpose. There appears to be some evidence that the tonnage required of each type roughly approximates to the proportion it bears to the whole output of the collieries. Further research into the constitution of coal in the direction indicated, undertaken jointly by coal owners and users, should help appreciably in arriving at a decision how the national coal resources can best be used.

Cable Recovery

LAST week we reported that St. Pancras had told the Ministry of Supply that it was not prepared to spend £1,259 to recover redundant cables worth, as scrap copper and lead, £688. Reports on the same subject which are reaching us from other parts of the country show that circumstances differ greatly from district to district. In another London borough, Battersea, it is stated that scrap copper and lead worth £1,030 can be recovered at a cost of £921. At Eccles, very much the opposite is the case. Here, it is said, an expenditure of £6,600 upon the recovery of redundant cables would result in obtaining only £680 worth of lead and copper. If the metal is needed, as it undoubtedly is, the cost is not to be counted. But in such a case as that at Eccles the adverse margin is certainly staggering. In any event any loss should be borne by the Ministry, that is, nationally not locally.

An Injustice Remedied

UNDER the National Joint Board Schedule power engineers are entitled to increases in their salaries after the first year of service up to and including the fourth year. Sometimes, owing to reduction of plant in service it becomes necessary to reclassify a station on a lower basis and salaries are thereby reduced. Some undertakings, which apparently thought they were observing the strict letter of the Schedule, have ignored service when effecting this reduction and placed their engineers on the starting salaries in the new class. We are glad to see that this obvious injustice has now been put right by an amendment to the Schedule. It is almost incredible that such a point as this should ever have arisen.

Metallurgy

PROSPECTS of electro-metallurgical industries in Great Britain are discussed in this issue by Mr. H. A. Sieveking in the light of the recent Act relating to Scottish water power. His survey extends the range from the ferro-alloys, to which reference was made in our leading article of September 10th, to cover all those processes that appear to offer reasonable chances of successful development. Power should be available at very low rates, provided transmission charges are inconsiderable, since the load factor of use would be high enough to take full advantage of the peculiar feature of hydro-electric generation that overall costs are hardly effected by increase in kWh output.

Valves

THE decision to alter the title of the British Iron and Steel Valve Manufacturers' Association to the British Valve Manufacturers' Association may lead to some confusion. There is already a British Radio Valve Manufacturers' Association, familiarly referred to as the "B.V.M.A."

Electro-Metallurgical Prospects

Effects of Scottish Hydro-Electric Development

By H. A. Sieveking, M.Sc.(Eng.), M.Inst.C.E., M.I.E.E.

THE Hydro-Electric Development (Scotland) Act, 1943,* may have a far-reaching effect on British electro-metallurgical industries. This Act was inspired by the Report of the Committee on Hydro-Electric Development in Scotland* (chairman, Lord Cooper), which recommended that Highland hydro-electric power sites should be developed and that the power made available should, after providing for general local supplies (Sec. 45), be utilised by electro-metallurgical industries which it was hoped would be attracted into the area (Secs. 38 and 39).

The Act authorises the establishment of a Board (Sec. 1) (similar to the Central Electricity Board) whose duties shall be (Sec. 2) to provide, in the North of Scotland, supplies of electricity to: (*a*) Ordinary consumers outside the areas of supply of existing authorised undertakings; (*b*) existing authorised undertakings; (*c*) "large power users," *i.e.* consumers other than authorised undertakings with a demand of not less than 5,000 kW; and (*d*) the Central Electricity Board. The special recommendations of the Cooper Committee are, without doubt, intended to be covered by class (*c*).

The products, the manufacture of which can reasonably be expected to be influenced by the Act, may be divided into two groups—electro-thermal, *i.e.* those requiring electricity for the production of heat in furnaces, which include ferro-alloys, calcium carbide, graphite and carbon products and abrasives; and electro-chemical, *i.e.* those requiring electricity for electrolysis and including aluminium, magnesium, chlorine (for bleaching powder) and copper refining.

Although the Report also includes the production of calcium cyanamide, vanadium, zinc and cadmium, the first two are quantitatively not of sufficient importance to be considered here, while zinc reduction (with which is associated the production of cadmium) will probably continue to be carried out more economically at the mine. Even with the artificial stimulus that was proposed before the present war in the way of increased duties and subsidies to Empire producers, it is still by no means certain that there would be

TABLE 1.—GROSS EQUIVALENT ELECTRICITY CONSUMPTION OF SOME BRITISH ELECTRO-METALLURGICAL PRODUCTS

Material	Gross Electricity Consumption kWh per ton	1929 Imports Tons	1929 Total Elec. Million kWh	1932 Imports Tons	1932 Total Elec. Million kWh	1935 Imports Tons	1935 Total Elec. Million kWh	1938 Imports Tons	1938 Total Elec. Million kWh
1. Abrasives:									
Carborundum	10,500	2,169	22·8	1,912	20·1	361	3·8	625	6·6
Corundum	3,500	14,772	51·7	11,126	39·0	32,484	113·7	33,061	115·7
2. Aluminium	26,000(1)	22,474	584·2	8,072	209·9	17,982	467·7	46,256	1202·7
3. Bleaching material (Chloride of lime)	2,500(2)	6,246	15·6	2,487	6·2	2,901	7·2	1,283	3·2
4. Calcium carbide	3,500	47,263	165·4	42,032	147·1	55,234	193·3	65,825	230·3
5. Carbon products(3):									
Graphite	(3,000–8,000 average say 5,000)	15,324	76·6	9,266	46·3	13,507	67·5	14,695	73·5
Amorphous		4,300	21·5	2,800	14·0	3,300	16·5	2,200	11·0
6. Copper, electrolytic	400	103,345	41·3	91,185	36·4	152,875	61·1	196,964	78·8
7. Ferro-alloys	8,700(4)	31,008	269·8	17,816	155·0	43,781	380·9	47,595	414·1
8. Magnesium	22,000(5)	149	3·3	50	1·1	1,426	31·4	1,612	35·5
9. Total electricity	—	—	1252·2	—	675·1	—	1343·1	—	2171·4
10. Electricity generated in C.E.B. Mid-East England Area	—	—	—	—	1,407	—	1,999	—	2,750
11. Total electricity generated in Gt. Britain (Ex. N. Scotland).	—	—	—	—	11,994	—	17,565	—	24,376
12. Ratio of Line 9 to Line 11, per cent..	—	—	—	—	5·6	—	7·7	—	8·9

(1) Electrolytic reduction only. (2) Chlorine requirements only; assuming 0·64 ton per ton bleaching powder. (3) Import tonnage estimated. (4) For fuller details of ferro-alloy requirements see *Journal* I.E.E. Vol. 90, Part II, No. 13, February, 1943, pp. 65–72. (5) Electrolytic reduction.

* H.M. Stationery Office.

sufficient inducement to British producers.

It is not always realised what a considerable load is offered by the electro-metallurgical industry. In Table I are listed the products already enumerated together with representative total electricity consumptions per ton (including lighting and auxiliary power but excluding conversion losses) required for their manufacture. It also gives the tonnage of each commodity imported in four representative years during the ten-year period ended in 1938, together with the equivalent electricity requirements. For comparison, the quantity of electricity generated in the C.E.B. Mid-East England Area and the total generated by stations in Britain under the control of the C.E.B. are also given. It will be seen that the electro-metallurgical electricity requirements of only the selected industries are equivalent to some 9 per cent. of the total generation of the country, and are rapidly approaching the output of a grid scheme area that includes such heavily industrialised localities as Sheffield, Rotherham, Leeds and Bradford.

The graph in fig. 1 shows the total consumption for each year of the ten-year period of all products included in Table I and, separately, the consumption of the electro-thermal (furnace) products. The curves in the graph have been projected along the approximate lines of growth of load and show that the probable 1943 demands would have been 3,200 million and 1,650 million kWh respectively, excluding the influences of the war. Fig. 2 shows the consumptions in the United States for the same industries over a ten-year period ended in 1936.

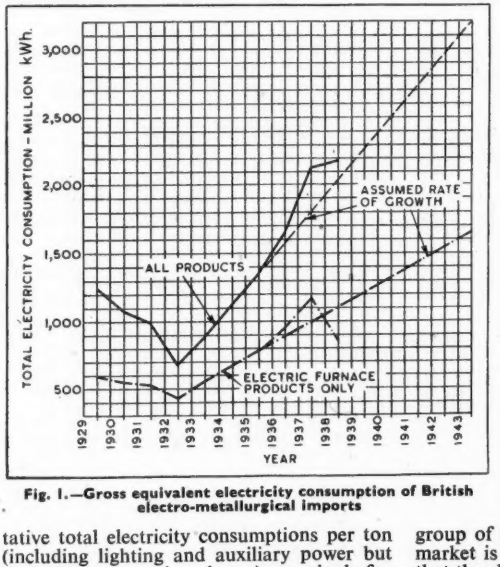


Fig. 1.—Gross equivalent electricity consumption of British electro-metallurgical imports

Comparison between figs. 1 and 2 shows that the slump following the 1929 boom was felt in both countries, though far less in Britain. The "trough" of the curves is in both cases in 1932 but lasts longer in the United States as regards the total, though in both countries the recovery in electric furnace consumption follows immediately. The long "trough" in the United States' total is mainly due to aluminium consumption remaining at a low level for three years. When recovery did start the rise was more spectacular than here, but owing to the relatively low total consumption in Britain in 1929, at the end of 1936 the 1929 value is passed though not yet reached in the United States. Two general deductions are to be drawn from the curves; *viz.* that in Britain we are still a long way short of "saturation" in the group of products under discussion and the market is therefore still a growing one, and that the electric furnace products show a less

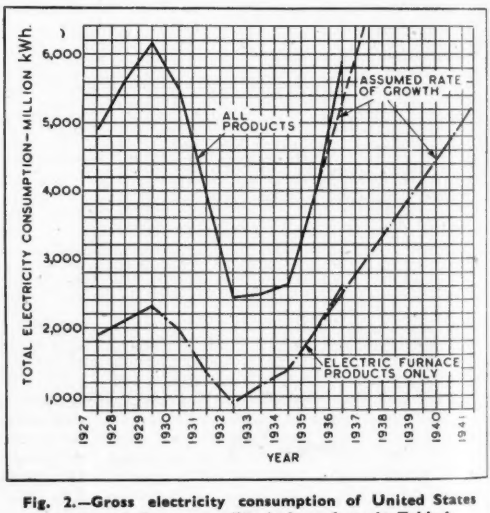


Fig. 2.—Gross electricity consumption of United States output of electro-metallurgical products in Table I

steep fall and quicker recovery at times of severe slump.

There is a further reason for segregating electric furnace users from the general total; furnaces are designed to work off AC mains, though certainly at very low voltages, whereas the electrolytic group requires DC, which implies either converting machinery (probably mercury-arc rectifiers) or generators installed exclusively for its use; the latter choice is unlikely at stations coming within the scope of the 1943 Act.

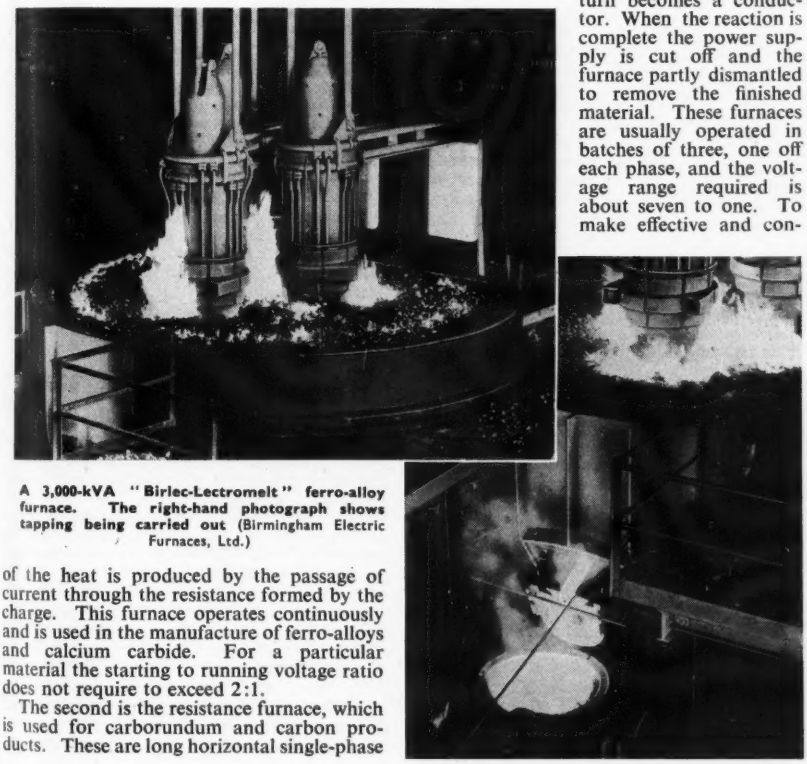
TABLE 2.—ESTIMATE OF APPROXIMATE ECONOMIC PRICE OF ELECTRICITY FOR VARIOUS ELECTRO-METALLURGICAL PRODUCTS

Material	Approx. 1938 Selling Price per Ton £	Elec. Cost %S.P.	Elec. Cost £	kWh per Ton	Economic Cost per kWh, pence
1. Abrasives (Carborundum) ..	39	30	11·7	10,500	0·268
2. Aluminium	94	17	16·0	26,000	0·148
3. Chlorine (for bleaching powder)	19	10	1·9	3,900	0·117
4. Calcium carbide ..	11	11	1·2	3,500	0·082
5. Copper (electrolytic) ..	42	1¼	0·525	400	0·315
6. Ferro-alloys					
Chrome (0·06%C) ..	50	10	5·0	18,000(1)	0·133
Manganese (0·5%C)	33	25	8·25	7,000	0·283
Silicon (75%Si) ..	16·5	25	4·1	9,000	0·110
7. Magnesium	168	12½	21·0	22,000	0·230

(1) Including electricity required for ferro-silicon used as a reducing agent.

Two types of electric furnace are employed. The first is the three-phase submerged arc in which the electrodes are suspended vertically into and through the cold charge. Arcing is very short and much of the heat is produced by the passage of current through the resistance formed by the charge. This furnace operates continuously and is used in the manufacture of ferro-alloys and calcium carbide. For a particular material the starting to running voltage ratio does not require to exceed 2:1.

The second is the resistance furnace, which is used for carborundum and carbon products. These are long horizontal single-phase furnaces with connections to the supply at each end. The body is charged with the raw material and a conducting core of carbon is made to carry the initial current; the heat so produced passes to the charge, which in its turn becomes a conductor. When the reaction is complete the power supply is cut off and the furnace partly dismantled to remove the finished material. These furnaces are usually operated in batches of three, one off each phase, and the voltage range required is about seven to one. To make effective and con-



A 3,000-kVA "Birlec-Lectromelt" ferro-alloy furnace. The right-hand photograph shows tapping being carried out (Birmingham Electric Furnaces, Ltd.)

tinuous use of the electricity supply and transforming apparatus, a second batch of furnaces is usually prepared and held ready so that there is immediate transference of power on the completion of the reaction in the first group.

In Table 2 the materials under consideration are listed with their approximate selling prices in 1938 and the percentages of the selling prices that have actually been paid for electricity by large producers (mainly U.S.); this percentage is expressed as a sum of money based on 1938 prices. Knowing the electricity consumption, the equivalent electricity price per kWh can be deduced and is shown in the last column.

Many factors influence the price—cost of raw materials and freight being the principal ones—but the figures quoted are at least indicative of the order of magnitude. Prices in the electrolytic group require to cover the conversion losses and annual charges on converting plant if any. The table shows that six (including magnesium) out of the nine products require electricity at under 0·2d. per kWh at the lower-voltage AC terminals—five of them at under 0·15d. The three cases which allow of prices in excess of 0·2d. per kWh—electrolytic copper, abrasives and ferro-manganese—account for only 10 per cent. of the 1938 electricity consumption. That such prices are not exceptional for hydro-electric power is confirmed by the contract entered into between the Tennessee Valley Authority and Monsanto Chemicals, Ltd., in 1936. The tariff is summarised in Table 3 and illustrations of its application to three different loads are shown in fig. 3.

Although the price that will be charged by the Board cannot be forecast, certain factors that will influence the tariffs may be pointed out. The limiting in the Act of large power consumers to those making a demand of not less than 5,000 kW (Sec. 27) is more important than at first appears, since it precludes the direct sale of electricity to a furnace installation of perhaps 2,000 kW (which would easily produce some 1,000 tons of low carbon ferro-chrome, not including the ferro-silicon required, plus 500 tons of high carbon (4–6 per cent.) ferro-chrome in 270 working days per annum). Thus small power sites will not be utilised or will require to bear the additional cost of transmission lines and switchgear of heavier rupturing capacity. Such an isolated hydro-electric plant could well run fully automatically, but when tied in with the main transmission system it would probably require to be remotely controlled, which, however simple the design, might add 30s. or more per kW to the capital cost.

A further factor influencing cost is the relation between the Board and the C.E.B. regarding exchange of electricity set out in Section 16 and the Fourth Schedule. The Cooper Report (Sec. 50) envisaged collaboration with the C.E.B. to obtain a market for surplus power. Section 16 (1) (*a*) of the Act makes it obligatory that the Board should give the C.E.B. three years' notice of any intention to reduce the maximum number of kilowatts and kWh to be made available below the previous year's maximum without special consent. It is true that Sub-section (2) permits the C.E.B. to purchase electricity additional to the main supply contracted for, but it is not to be anticipated that a price much in excess of the average bare cost of

TABLE 3.—SHORT SUMMARY OF T.V.A. TARIFF TO MONSANTO CHEMICALS, LTD. (1)

Item	Cost (2) d.	Remarks
Kilowatts: Firm	45 per month	Available at any time } In any month "firm" kW = actual 60 minute demand up to 8,000 kW; above 8,000 = 35 per cent. of actual demand or 8,000, whichever is the greater. P.F. not less than 85 per cent.
Secondary	15 per month	Available 300 days per year }
kWh:		
Up to 100,000 per month ..	0·2 each	Over 50 per cent. load factor in the month additional kWh carry a discount of 0·025d. per kWh.
next 200,000 per month ..	0·15 ,,	
next 700,000 per month ..	0·125 ,,	
over 1,000,000 per month ..	0·1 ,,	
SUPPLY		At 11·9 kV at one point in customer's grounds.

(1) Annual Report of T.V.A. 1936 pp. 195–205.
(2) Assuming 1 cent = 0·5d.

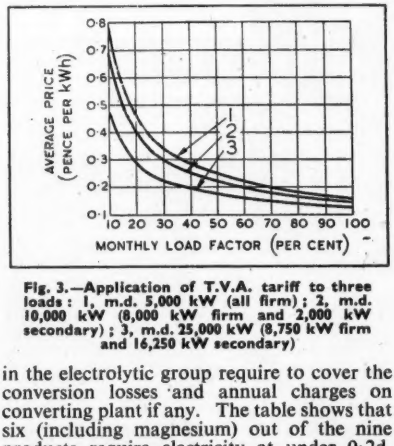


Fig. 3.—Application of T.V.A. tariff to three loads: 1, m.d. 5,000 kW (all firm); 2, m.d. 10,000 kW (8,000 kW firm and 2,000 kW secondary); 3, m.d. 25,000 kW (8,750 kW firm and 16,250 kW secondary)

coal for steam-produced kWh in the Central Scotland Area would be paid—certainly not a price as high as that allowed for in the Fourth Schedule.

While three years' notice is no doubt desirable from the C.E.B. point of view, when it is recollected that such a period must elapse between the sanctioning and putting into commission of generating plant at a steam station, it will result in very conservative contracting on the part of the Board to avoid having to curtail supplies, due to say low water, to consumers under any of the first three headings of Section 2 of the Act and will also tend to restrict free development since an electro-metallurgical factory, even of some size, could be erected and in operation in well under three years.

Again, purchases of electricity from the C.E.B. are governed by Section 16 (3) which places the Board on the same footing as authorised undertakings in the Central Scotland Area and therefore, presumably, will make it necessary to purchase supplies at the grid tariff for that area. Even if the demand on the C.E.B. is restricted to the summer months a kWh charge of over 0·2d. (0·268d. in 1938) is payable together with a kilowatt charge on two-thirds of the kilowatts contracted for. The only relief that can be hoped for is that offered by Section 2 of the Electricity (Supply) Act, 1935, permitting special prices in exceptional circumstances; even so, a price of less than 0·2d. per kWh without kilowatt charge is not likely to be obtained on 1938 costs.

Load Conditions

An effective "balancing up" of power supply and demand does not, on the face of it, appear likely at first, though no doubt when the difficulties arise means will be found of overcoming them. It remains, therefore, to determine how far the electro-metallurgical load can be adjusted to meet fluctuating water supplies and avoid coincidence with the demands made by other consumers.

If, in a district such as North Scotland, the water power obtainable at all times during the year be taken as unity, it may roughly be said that during 75 per cent. of the year the power available will be 1·5 and during 50 per cent. of the year 3. A certain amount of monthly levelling out can be obtained with storage, but only where the head exceeds approximately 200 to 300 ft., otherwise the storage space required becomes excessive. The Cooper Report (Sec. 33) estimates on full development that approximately 4,000 million kWh per annum will be available. On the above annual division this would represent some 160 million kWh per month for three months of the year, 235 million per month for a further three months, and 470 per month during the remaining six months.

Now the electro-metallurgical load is inherently a steady one over the twenty-four hours for many weeks on end. It is also a characteristic of the electro-thermal load that small capacity units may be economically installed and show production costs that are but little different from large units. Some electrolytic loads (*e.g.* copper refining) can be made to vary within wide limits (40 per cent. during the day) by adjusting the DC supply voltage without appreciably affecting the efficiency of the cells. It would seem therefore that the installation of a relatively large number of furnaces together with electrolytic processes would allow the best use to be made of the power available, all the plants being located as near as possible to the source of power in order to minimise transmission costs.

On the assumption that 3,200 million kWh represents the total supply available for electro-metallurgy, *i.e.* 4,000 minus 340 (for local consumers) and 460 (for losses), the kilowatt capacity of the consuming plant on an 80 per cent. annual load factor would be 460,000. Some 70 per cent. or, say, 2,250 million kWh is, however, available during six months of the year, when the load factor would probably be kept at 90 per cent., which corresponds to a consuming capacity of 570,000 kW or an increase of about 25 per cent. Such an increase in the maximum consuming capacity is quite reasonable to obtain the benefit of very low power costs.

It will be noted that the maximum number of kWh available corresponds to the estimated 1943 requirements for the group of products considered (fig. 1) and indicates that, given a sufficiently attractive price, the electricity made available could easily be absorbed.

In conclusion, attention is drawn to Section 25 of the Act which empowers the Board to conduct experiments or trials for the improvement of generation, distribution or use of electricity. Such powers are a valuable contribution towards aiding scientific research, both on water turbines and on electro-metallurgy, and lead to the hope that reports will be issued having considerable authority.

Institute of Marine Engineers

EXAMINATIONS for admission to the Institute of Marine Engineers will be held as follows:—Students (common preliminary examination).—April 18th to 21st and October 3rd to 6th, 1944. Graduates (Section A of associate membership examination).—June 5th, June 7th and 9th, 1944. Associate members.—June 5th to June 12th, 1944. Syllabuses of these examinations, copies of previous papers, and particulars of exempting qualifications will be supplied on application to the Secretary, at 73, Amersham Road, High Wycombe, Bucks.

An examination for the award of a Lloyd's register scholarship in marine engineering, value £100 a year for three years, tenable at a British university, will be held on June 5th to June 9th, 1944. Candidates must be British subjects between the ages of 18 and 21.

Transformer Restrictions

Particulars of New Order

BRIEF reference was made last week to the Electrical Transformers Order, 1943 (S.R. & O. 1943 No. 1353, Stationery Office, 1d.). This prohibits the manufacture of certain types of transformers, except under licence from the Board of Trade, otherwise than in accordance with a schedule to the Order. This schedule is based on Amendment No. 1 (February, 1943) to B.S. 171-1936 (Transformers for Power and Lighting) and B.S. 355-1939 (Mining-type Transformers) the primary purpose of which is to ensure the maximum economy in materials and labour. The types are set out in the first schedule to the Order. They are as follows:—

Oil-immersed, naturally-cooled transformers (*a*) for power or lighting use from 5 to 7,500 kVA inclusive in the case of three-phase transformers or from 5 to 2,500 kVA in the case of single-phase units adapted for use on single-, two- or three-phase circuits at from 700 to 40,000 V inclusive; (*b*) for mining use from 10 to 300 kVA (inclusive) in the case of three-phase transformers, or 10 to 50 kVA (inclusive) in the case of single-phase transformers, adapted for use on single-, two- or three-phase circuits at from 700 to 40,000 V (inclusive). The schedule does not cover constant current power or lighting transformers, instrument transformers, transformers for electric locomotives or other vehicles and used for supplying traction energy, testing transformers, auto-transformer starters or induction regulators, and transformers for use with mercury arc rectifiers or rotary convertors.

The restrictions on manufacture of these transformers are given in the second schedule. It is provided that transformers required to give a three-phase output shall not be manufactured in single-phase units.

Limitation of Sizes

No power or lighting transformer shall be manufactured of a rating other than:—(*a*) in the case of a three-phase transformer, 5, 10, 25, 50, 100, 200, 250, 300, 500, 750, 1,000, 1,500, 2,000, 3,000, 5,000 or 7,500 kVA; (*b*) in the case of a single-phase transformer, 5, 10, 25, 40 or 100 kVA.

No mining transformer shall be manufactured of a rating other than:—(*a*) in the case of three-phase transformers 10, 25, 50, 75, 100, 150, 200, 250, or 300 kVA; (*b*) in the case of a single-phase transformer, 10, 15, 25 or 50 kVA.

The tapping range for off-circuit voltage changing shall not exceed 12 per cent. of the service voltage, and the number of voltages resulting from such tappings shall not exceed four. This paragraph and the preceding one do not apply to "a transformer manufactured in the execution of a contract for a transformer required for direct connection to electric furnaces or electric welders."

No transformers of a rating less than 500 kVA shall be equipped with on-load tap-changing equipment.

The value of the flux density in the core legs of any transformer resulting from the input service voltage applied to the service voltage terminals or tappings shall not be less than that specified in the third column of the Table shown in paragraph (*c*) of the Amendment No. (1) of February, 1943, to B.S. 171-1936 and B.S. 355-1939 in relation to the kVA rating of the transformers. Provided that in the case of a transformer manufactured in the execution of a contract for a transformer required for direct connection to an electric furnace and for use with a contactor on the primary side the value of such flux density may be not less than 10,000 lines per net sq. cm.

Iron and Copper Losses

The value of the iron or copper losses or both such losses of any transformer shall not be less than that shown in Schedule B of the above Amendment in relation to the kVA rating of the transformer. This paragraph does not apply to (*a*) Scott-connected transformers or other three- to two-phase transformers, three- to single-phase transformers or two- to single-phase transformers, (*b*) a transformer manufactured in the execution of a contract for a transformer required for direct connection to furnaces or welders.

The limits of temperature rise of transformers shall be in accordance with Table 5 in Section 7 of B.S. 171-1936, subject to a tolerance of two degrees Centigrade.

No transformer for power or lighting shall be equipped with fittings (including rollers) other than oil-conservators, vents, breathers and those fittings specified in Tables 14 or 15 in Appendix H of B.S. 171, fitted to transformers of the types therein specified in relation to the appropriate fitting. No mining-type transformer shall be equipped with tank fittings other than those specified in Clause 8 of B.S. 355-1939 fitted to transformers of the types specified in relation to the appropriate fitting. No transformer shall have rating plates, diagram plates or name plates made of stainless steel, and no joint surfaces shall be machined.

The expression "service voltage" has the meaning assigned to it by Clause 2 of B.S. 171-1936.

Lighting and Labour

Improvement of Factory Conditions

By E. B. Sawyer, F.I.E.S.

(E.L.M.A. Lighting Service Bureau)

WE are now entering the fifth winter of war, and from the illumination point of view the present lighting season can be looked upon as the last during which the installation of improved lighting for war production can be justified. This is not stated with any element of wishful thinking or false optimism, but as a spur to immediate effort to convince the many small and medium sized factories that their production can be speeded up and the working conditions of their staff improved with the introduction of sufficient and suitable lighting; an extra tank, aeroplane, or ship this winter means a quicker victory. From the point of view of expenditure, wartime lighting installations should be treated as an expense allowable for income tax purposes and not as captial expenditure.

The argument is often advanced that what has sufficed for four years will do until the end of the war, when there will be time to think about improvements; but this entirely loses sight of some of the fundamental changes the war has brought about, such as the cumulative effect of fatigue after four years of war production; new and continuous comb-outs of labour for the services (those workers left are four years older and new ones well above former average age); change-over in production from one priority product to some other; the need to reduce the high rate of industrial accidents; and the change in the psychological attitude of workers as the war situation improves.

Under war conditions, it is necessary to forgo many things to have a sufficiency of those which are of even greater importance and one may rightly ask "Is the installation of improved lighting justified at this time?" The argument for good factory lighting can be advanced in two parts; one dealing with the production of light, the other with its utilisation.

Discharge Lamp Installations

Much has already been written on the production of light and no Order yet promulgated has made it impossible to provide a reasonably sufficient quantity of light for any given industrial process, at least so far as interior lighting is concerned. Even the new Statutory Rules & Orders 1943 No. 1201, by which a licence is required before installing electric discharge lamps, does not restrict lamps for replacements. This Order is merely intended to ensure that discharge lamps are used only for essential war work, and as a guide, application for a licence is unlikely to succeed unless conditions such as the following are fulfilled:—

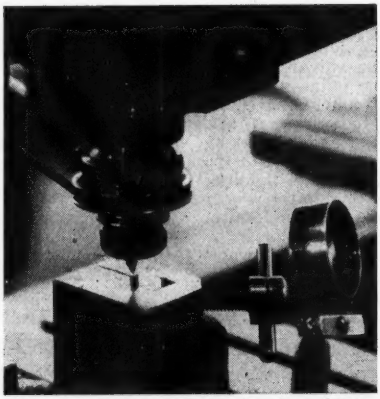
1. The part of the factory concerned is engaged on essential war production :—(*a*) Where processes carried out in artificial

Electrical control gear, small motors, and some of the plant finished in light colours with a clean light-coloured floor assists the lighting and avoids the gloom of a dark ceiling

light involve fine work, accurate measurements or close inspection; (*b*) where colour discrimination is essential and incandescent lamps with colour-correcting devices would otherwise have to be installed; (*c*) where the use of other systems of lighting would result in serious reflected glare or difficult shadows; or (*d*) where low mounting height makes the provision of adequate diffused illumination impracticable by other means.

2. Where important war work is being carried out in permanently blacked-out or underground factories, and in buildings or portions of buildings which are permanently blacked-out, *e.g.*, citadels, control rooms, and so on (excluding office corridors, store rooms, lavatories, canteens and other accommodation where actual work of production is not being undertaken).

3. Where an increase in the level of existing illumination is necessary and the adoption of such lighting avoids the need to increase the size of conductors in the circuit, thus effecting a considerable economy in plant, copper, electricity, etc.



When the correct quantity and quality of light is provided it may still be necessary to assist the eye with suitable lenses

Light Aids Production

The utilisation of light is a fruitful field for theories and experiment. So far as is known there have been no investigations in this country analysing and evaluating the psychological reactions of workers according to the class of work on which they are engaged, the lighting, the colour of the surrounds, the temperature, etc. But the mere fact that foundry-work, for instance, is heavy, hot and smoky seems a poor reason for foundries to be dark and gloomy, and in fact a trial installation of artificially illuminated laylights in one foundry was found to cause a material increase in production and a feeling of well-being amongst the occupants, besides apparently reducing the smoky effect; so much so, in fact, that it was the general belief that the ventilation had also been improved.

Due to (possibly misplaced) secretiveness, figures of increase in production with improved lighting are difficult to obtain in this country, but some obtained in Australia over a two-month period on Rolls-Royce Merlin cylinder production are worth noting:—Rough turning, 20 per cent.; camming, 28½ per cent.; grinding, 25 per cent.; deburring, polishing and stamping, 100 per cent.

Accompanying, and partly accounting for, the increase in production in the machining operations is the fact that with the old system, operators when nearing the completion of their cut, had to bend closely over the surface being machined, consequently the number of eye injuries was high and the frequent use of micrometers caused eyestrain; with the new lighting, accidents over a three-month period were nil and micrometer readings are now taken without strain.

Colour and Brightness

The acuity of the eye is partly regulated by the brightness of the surroundings up to 1/100th or 1/10th that of the work, but at higher brightness of the surrounds until equality with the brightness of the work is reached there is a slight depression in acuity. White walls may, therefore, not be ideal when work is being done on dark materials, for in such circumstances the extra light gained by reflection from the white walls may be more than off-set by the lower efficiency of the eye.

Light surroundings are needed partly for their psychological effect and partly to reduce fatigue caused by frequent re-adaptation of the eyes of a worker looking up from brightly lighted work into comparative darkness. The eyes of a worker concentrating on fine work are in a state of tension; to rest he looks up and away so as to obtain a change of focus. If the surrounds are light, this is effective; if, on the other hand, they are dark, he subconsciously sees shapes and tries to focus on them to discover their nature; his inability to do so or to see anything clearly causes annoyance, wastes time, and annuls what should have been a rest period.

Walls up to approximately 5 ft. from the floor should be finished in pale colours with a reflection factor of approximately 40 per cent. Suitable colours with their reflection factor for tungsten filament light are:—(*a*) Cold colours: Eau de nil, 47 per cent.; silver grey, 37 per cent.; middle stone, 37 per cent.; (*b*) Warm colours: Orange, 42 per cent.; salmon pink, 44 per cent.; peach, 55 per cent.

Above this level, walls and stanchions should be finished in colours with a higher

reflection factor, up to 70 per cent. : cream walls with girders and ceilings painted white are ideal. Where practicable, floors should also be light in colour. Some American aircraft factories have white cement floors which have made it possible by reflected light to see clearly under the wings of large bombers, and have proved perfectly satisfactory in practice.

The colouring of machines has progressed beyond the experimental stage. In general, the two-colour system is most effective, a good colour combination being medium grey on the body of the machine, with light buff around the control and tool areas. Light green and light buff have been used on machines as a whole and have been quite practical in so far as maintenance is concerned. From the safety point of view, the most significant feature is the three-dimensional visual effect secured by the controlled colour contrast of two-colour schemes.

Shape of Things to Come

Wartime experience is giving lighting engineers all over the world useful data for the future, not so much in lighting large factories but in solving the lighting requirements of processes which cause production bottlenecks. An American example of interest is the lighting of a plant producing welded tanks. For the welding area an illumination of 150 ft.-candles is provided, reflecting surfaces were painted with zinc-oxide base paints to absorb the ultra-violet rays. When welding, the workers' eyes are protected by heavy filter glass in hoods which cut down the brightness of the arc to 1 per cent.; when not welding and without the hood there is no great change in brightness. The workers on non-welding jobs are provided with goggles with special lenses so that they can move about in proximity to the arcs in complete freedom, the high level of illumination enabling them to see with safety through the absorbing lenses.

Maintenance

In the design of a lighting installation the engineer makes an allowance for the inevitable drop in illumination due to the deterioration of the light source and the colour of the decorations. This may vary, but for normal conditions and assuming reasonable maintenance, a factor of 1·43 is general.

All too little attention has, however, been given to the question of accessibility of the fittings and to the problems of the maintenance engineer. This has largely been due to the cost, and in the future it may be necessary to balance the cost of special equipment against the annual maintenance charges. Where of necessity fittings have to be mounted at great heights and in relatively inaccessible positions, consideration will have to be given to the installation of fittings with raising and lowering gear, or in some circumstances fittings with dust-proof visors.

A regular definite system of maintenance should be practised for all installations, which should include skylights and ceilings, lighting fittings, side windows and walls, interior obstructions, and machines. Regular lightmeter readings will indicate the desirable frequency of cleaning periods.

Voltage has a considerable effect on illumination. An under-voltage of 4 per cent. reduces light by 16 per cent. for gasfilled lamps or about 4 per cent. for discharge lamps, varying according to type. Choke tappings should be selected to suit the *actual*, not the declared average mains voltage.

It will be appreciated that at the present time some of the above recommendations cannot be acted upon, but none should be turned down without carefully balancing the long-term saving against the initial expenditure, labour and material.

Whilst not directly related to the maintenance of fittings, the subject of fire prevention is topical. With good lighting the pile of shavings or rubbish into which a carelessly thrown cigarette might fall would probably not be there.

Group Replacements

In order to facilitate cleaning and to reduce the time during which belting and machines might have to be stopped, a proportion of fittings in excess of those installed might be carried in store, so that perfectly clean fittings can be put up in batches with the minimum delay, and the dirty fittings they have replaced can be cleaned at leisure at floor level. Frequently, too, a group replacement plan of re-lamping at, say, 90 per cent. of average lamp life, to coincide with cleaning periods, is financially justified.

Improved lighting has been proved to increase output in normal times, and especially is this true now that operatives are in general less skilled and less familiar with their tasks than in peacetime. Some have been transferred from their normal work, others, after a period of training, are doing factory work for the first time, and for such workers visual concentration must in part take the place of manual dexterity.

It has also been established conclusively that better lighting means fewer accidents. To give a concrete example, increasing the illumination from 6 ft.-candles to 16 ft.-candles in a general engineering shop resulted in a 20 per cent. decrease in the accident rate. The Chief Inspector of Factories reported in 1941 that accidents in factories cause from 20,000 to 30,000 workers to be constantly off work. The loss of production represented by the 50 million man-hours per month involved is too serious to ignore and surely worth the expenditure of a few tons of steel for lighting fittings, and a few man-hours for the manu-

facture and erection of new lighting installations.

Many elderly people take to glasses as their eyesight fails, but whether they do so or not they also need good lighting, as both are effective aids to seeing, making it possible for the many older people employed in industry to-day to do good work, for, even when such people are well fitted by experience to do their work, failing sight is a severe handicap.

The depressing and gloomy appearance of many factories, together with inadequate and unsuitable lighting, which causes eyestrain and minor ailments, is undoubtedly impeding the war effort causing, as it does, a great deal of absenteeism. The worker who lunches and rests in a peach-coloured canteen, works in a cheerful factory, and passes along clean bright corridors and stairways, may be weary after a good day's work, but not too depressed at the thought of more work on the morrow.

The lighting engineer, even in these times, has a fairly easy job as regards provision of sufficient light for any given process. His skill can really be measured by the manner in which the lighting effect in the whole interior avoids, not only the obvious major faults, but also the minor ones—little points of glitter here, faint but awkward shadow there, too much or too little contrast somewhere else, and so on—which are apparently of little importance in themselves, but which lead to increasing exasperation throughout a long and hard day.

Electricians' Wages

Amendment of War Adjustment Agreement

IN November, 1939, it was agreed between the National Federated Electrical Association and the Electrical Trades Union that the then existing rates of wages in the electrical contracting industry should be stabilised for the period of the war and that variations in the cost of living from the August, 1939, figure (155) should be met by a fluctuating weekly addition to wages.

This agreement has continued in force until the present time but in response to a claim by the E.T.U. it has now been amended to provide that the war addition shall be calculated on an hourly instead of a weekly basis. The circumstances are dealt with in our leading article this week.

The new agreement says:—"The war addition shall in future be arrived at on the same basis as now calculated but shall operate on an hourly basis and thus rank for overtime. The Committee at its three-monthly meeting shall, in arriving at the rates payable for the ensuing three months, calculate the net result of the variation (if any variation be called for by the terms of this agreement) and shall declare the resultant net hourly addition. In making such calculations any final fraction of a penny less than one-eighth shall be ignored and any final fraction of one penny of one-eighth or over shall be counted as one farthing."

The new arrangement operates as from the second pay day in October for the period covered by that pay day and the war addition is to be 4½d. per hour from then until the second pay day in January next. Thereafter the alteration will take effect from the third pay day in the month instead of the second as heretofore.

Clause 3 of the new agreement stipulates that any claim for an increase in the base rate which the E.T.U. now submits shall be referred to an independent arbitration mutually agreed upon, assisted by two assessors appointed by the Minister of Labour after consultation with the parties and drawn from the building industry. Immediate effect is to be given to any arbitration under this clause.

The original agreement contained no provision for its determination upon the giving of due notice by either party. This has been remedied by a clause providing that the agreement may be amended or terminated by either side subject to six months' written notice, lapsing in March or September of each year, "or at such other period as may from time to time be agreed."

As before, the payment of the war addition is to be made to all journeymen electricians and assistants over 21 years of age.

With the addition the hourly rates of pay for journeymen electricians are now as follows:—Grade A (London), 2s. 3½d.; Grade B, 2s. 0½d.; Grade B2, 1s. 11¼d.; and Grade C, 1s. 11d. The pay of electricians' mates remains at 80 per cent. of the previous rates, plus the 4½d. per hour.

Municipal Trading at Luton

THE chairman of the Luton branch of the Electrical Contractors' Association is to be invited to an interview with the town clerk and borough electrical engineer on the question of trading from the Council's electricity showroom. This decision follows a letter to the Council from the branch referring to the undertaking given by the Council to local electrical contractors not to sell wiring and other accessories from the showroom. While agreeing that the undertaking had been well observed, the letter stated that the Council was now displaying replacement elements for irons and other small accessories in its showroom windows.

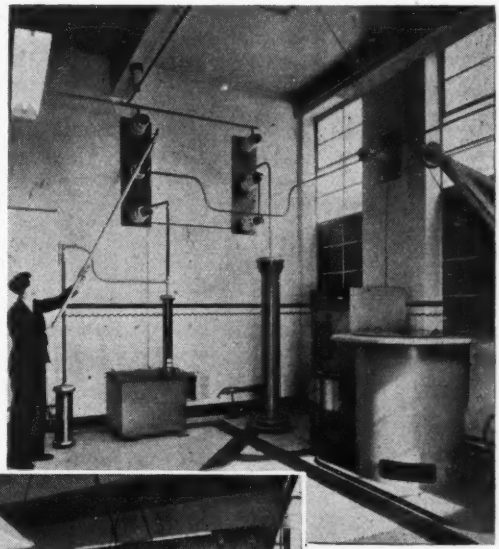
Specialised Laboratory

High-voltage Testing of Insulating Materials

IN view of possibilities of considerable development in insulating materials requiring consistently exact electrical properties, Turners Asbestos Cement Co., Ltd., decided to construct a comprehensive series of experimenting laboratories. These included one for the high-voltage testing of insulating materials in conformity with B.S. Specifications.

The solution of the problem was left entirely to the Metropolitan - Vickers Co. which designed, equipped and installed the electrical testing laboratory. AC is provided by three transformers designed for 105 kV, 35 kV and 6·6 kV. The 105-kV transformer (5·3 kVA continuous rating) is oil-immersed in a square tank and has cross-over wound waxed coils similar to those used in X-ray equipments. The 35-kV transformer is similar in design. DC supply up to $\pm$ 50 kV is obtained from a set which is fed from the 35-kV transformer through change-over connections and consists of a filament transformer with a thermionic rectifier mounted on it.

The 105-kV unit is controlled by a "Variac" auto-transformer giving smooth regulation from zero; the voltage is measured by a "crest" voltmeter. From the same desk under the testing cage is controlled the 35-kV or the 6·6-kV transformer, only one of these being in use at a time. Two systems of solid - drawn brass - tubing busbars are run overhead round the wall of the high-voltage chamber and fitted with change-over switches. One busbar system is insulated for 105 kV and the other for 35 kV.

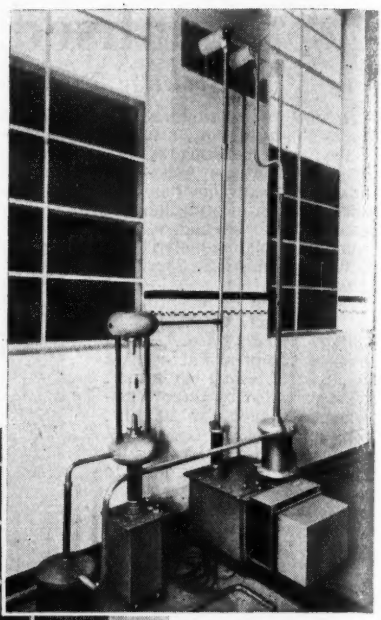


General view of the electrical testing laboratory of Turners Asbestos Cement Co., Ltd., and (top photo) the 105-kV transformer in square tank with crest voltmeter on left, compressed air condenser, oil tank and its control on right

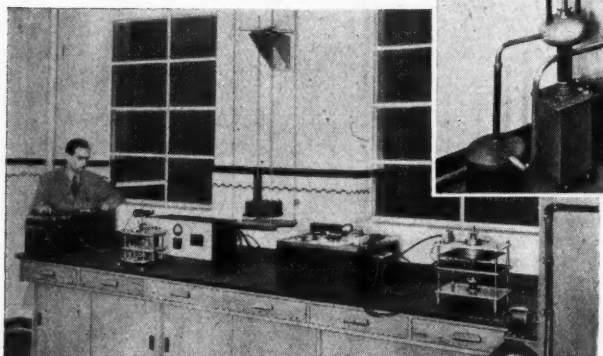
The main tests to be carried out are for high-voltage breakdown in air or in oil (hot or cold), power loss-factor, resistivity (surface and volume) and surface leakage. In

the first of these an increasing voltage is applied across a specified thickness of material until either breakdown occurs or the material can be certified for the voltage used.

Power loss-factor tests are based on the capacity effect set up when an alternating voltage is applied to an insulating material and on its magnitude and power factor. The specimen under test becomes for the moment the dielectric of a condenser in which capacity currents are produced, leading the voltage in phase by 90 deg., just as the same conditions across a conducting medium set up induced currents lagging 90 deg. behind the voltage. The power loss-factor is defined as the product of power factor and permittivity, both of which are derived from the readings of a Schering bridge, which can be used with specimens stressed at any voltage up to 105 kV. The standard condenser is of the compressed-air pattern. The Schering bridge is,



The 50-kV DC set on left and 35-kV transformer on right



The insulation resistivity test in progress and the audio-frequency Schering bridge in three sections

in effect, a Wheatstone bridge in which two of the resistance arms are replaced by condensers and one of them is paralleled by a condenser. For radio-engineering materials an audio-frequency Schering bridge is used.

There are ovens for normal conditioning, tropical conditioning and hot drying from 50 to 100 deg. C. and from 100 to 200 deg. C. All four are furnished with circulating fans. The "hot" and "tropical" ovens also have thermostats and Metrovick tubular heaters and humidity is provided for.

Supplies up to 35 kV are brought by an extension of the tubular busbar into the top of the oven through an isolator and an insulating bushing. The isolator when fully open operates an interlock so that the oven door cannot be opened without switching off the high-voltage transformer unless the isolator has been opened first. A small window in the door, similarly interlocked, gives access to the oven interior without seriously affecting the temperature. The testing cage is also interlocked electrically to cut off supply when it is opened.

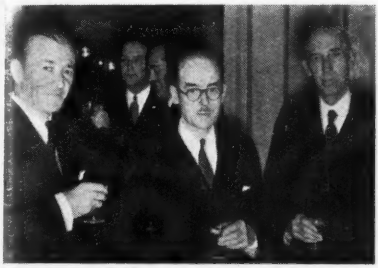
The testing equipment for surface and volume resistivity measures the current through the specimen produced by a known DC voltage across it. This current is determined by a sensitive reflecting galvanometer.

The DC voltage is supplied by a potentiometer-controlled voltage-doubler circuit employing Stabilovolt tubes and fed from Westinghouse rectifiers. The electrodes are of mercury or graphite in accordance with B.S.I. recommendations. The surface-leakage tester comprises an ordinary "Megger" in conjunction with a special comb with twenty-five contact points $\frac{1}{4}$-in. apart and alternately positive and negative.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT the Radio Industries Club luncheon held on September 28th, the opportunity was taken of formally congratulating **Sir Noel Ashbridge**, the Club's president, upon his recent appointment as deputy director-general of the B.B.C. Sir Noel on this occasion was also the principal



Sir Noel Ashbridge with Mr. H. de A. Donisthorpe, chairman of the Club, and Mr. A. J. Dew
[Photo: Odhams Press

speaker and made some interesting comments on post-war broadcasting which, he said, were personal rather than official views.

Mr. F. Seddon, A.M.I.E.E., has been appointed meter superintendent to the Sheffield Corporation Electricity Department. Before joining the Sheffield undertaking in 1940, as meter standardising engineer, he was meter superintendent to the Walsall Corporation Electricity Department, and held previous appointments with the Shropshire, Worcester & Staffordshire Electric Power Co. and the Metropolitan-Vickers Electrical Co., Ltd. His technical training was obtained at Wigan Mining & Technical College.

The Staff Committee of Fulham Borough Council reports that **Mr. J. A. Carr,** assistant control engineer, and **Mr. E. S. Nicholls,** auxiliary control engineer, have tendered their resignations in order to take up appointments with the Central Electricity Board. **Mr. A. D. Bone,** assistant instrument engineer, has also resigned on securing an appointment with the Northmet Power Co. To fill the vacancy caused by the recent resignation of **Mr. T. E. R. Sanderson,** electrical tester at the power station, the Committee recommends the promotion of **Mr. W. H. Woithe,** assistant electrical tester.

Mr. G. R. Hunter, shift engineer at South Shields Corporation electricity works has been appointed to a similar post with the Newcastle-under-Lyme Corporation.

Mr. R. A. Blakeborough, chairman of J. Blakeborough & Sons, Ltd., has been elected chairman of the British Valve Manufacturers' Association for the ensuing year in succession to **Mr. O. E. Dickinson.**

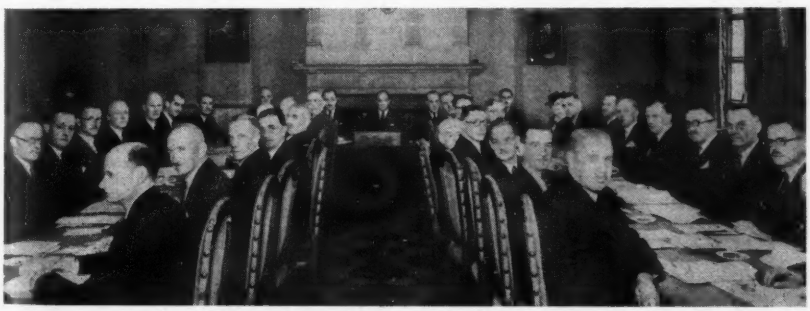
Mr. W. R. T. Skinner has been appointed general manager of the Yorkshire Electric Power Co., in succession to the late Col. H. C. Fraser. Mr. Skinner has been with the company for twenty-two years. He was for six years (until 1939) hon. secretary of the North Midland Centre of the I.E.E.

The post of county lighting engineer for Lanarkshire has been filled by the appointment of **Mr. David Lawson,** A.M.Inst.C.E., a native of Bellshill, who has been in the service of Lanark County Council since 1927.

Mr. H. E. Turner, manager of the Hull branch of the General Electric Co., Ltd., was recently elected chairman of the Hull Branch of the Incorporated Sales Managers' Association.

York Corporation Electricity Committee has appointed **Mr. L. Laughton** of Skelmanthorpe, Huddersfield, as analytical chemist at Foss Island power station.

Mr. W. Warren, A.M.I.E.E., A.M.I.Mech.E., the new president of the Derby Society of Engineers, is to deliver an address on " Generation of Electricity in Great Britain " at the opening meeting of the Society on October 11th. At the same meeting prizes won during last session will be presented by the Mayor of Derby



Representatives of British Insulated Cables Ltd., photographed at the company's annual sales conference held recently under the chairmanship of Mr. F. Waine, J.P., executive manager (commercial)

(Alderman H. A. Hind), who will also make a presentation on behalf of the members to **Mr. C. Carmichael,** who has completed twenty-one years as hon. secretary.

Mr. G. R. Sharpley, J.P., chairman and managing director of Ruston & Hornsby Ltd., retires from the latter position at the end of the year. He will continue to be the chairman of the company. Mr. Sharpley has been with the company for over fifty years, and has occupied the office of managing director for nearly twenty-five years. **Mr. V. W. Bone,** who is a member of the board, will relinquish the position he has held since its formation in 1930 of managing director of Ruston-Bucyrus Ltd., an associated company of Ruston & Hornsby Ltd., and will be Mr. Sharpley's successor as from January 1st, 1944. Mr. Bone has been connected with Ruston & Hornsby and its associated companies all his business life. The board of Ruston-Bucyrus Ltd., has appointed **Mr. E. S. Everitt,** at present the assistant managing director, to succeed Mr. Bone as the managing director of that company.

Mr. G. R. Sharpley

Mr. V. W. Bone

The post occupied by **Mr. R. Kelf-Cohen,** principal assistant secretary in charge of the Gas and Electricity Division of the Ministry of Fuel and Power, will in future carry the title of "Director of the Gas and Electricity Division" of the Ministry. The address of the Division is New Oxford House, Bloomsbury Way, London, W.C.2 (telephone:—Holborn 4311).

In giving the brief biographical details of **Mr. T. E. Houghton,** chairman of the Mersey and North Wales (Liverpool) Centre of the I.E.E., in our issue of September 24th, we referred to his work for the I.C.I. We wish to make it clear that I.C.I. (General Chemicals), Ltd., was the company referred to.

Mr. F. W. Sutton, who has been appointed Midlands Area sales representative to the General Cable Manufacturing Co., Ltd., has been with the company for twenty-three years and in recent years has represented it in the North of England Area. Mr. Sutton served in the last war, rising to the rank of major, and was for two years during this war a captain in the Royal Artillery.

We regret that in our last week's reference to the golden wedding celebration of **Mr. F. B. Woodruff** he was incorrectly described as manager of the Twickenham office of the London and Home Counties J.E.A. Mr. F. W. Purse, chief engineer of the L.J.E.A., informs us that Mr. G. W. F. Horner, the district officer, is in charge at Twickenham.

Mr. Frank Spalton has transferred his activities from the Lighting Service Department of the Crompton Parkinson organisation to the more recently acquired products of electric vehicles and trucks. He will be responsible for the development in the Midlands of "Morrison-Electricar" vehicles and "Electricar" works trucks.

Mr. W. F. Sims, chief electrical engineer of the Commonwealth Edison Co., has retired after thirty-two years' service with the company. He has been succeeded by **Mr. G. M. Armbrust,** assistant chief engineer.

Obituary

Sir J. Fortescue-Flannery.—We learn with regret of the death, in his ninety-second year, of Sir James Fortescue-Flannery, Bt., chairman of Callender's Cable & Construction Co., Ltd.

Mr. C. G. Stanesby.—The death occurred on September 29th, at the age of seventy-two, of Mr. Cecil George Stanesby, late secretary of the Charing Cross Electricity Supply Co., Ltd. Mr. Stanesby retired from the company owing to ill-health in 1935, after being secretary for many years and serving it in that and other capacities for thirty-eight years.

Fatalities

Electric Cable in Field.—At the conclusion of an inquest in a north-west locality on a two-year-old boy, Michael Stevenson, the coroner, returning a verdict of "Accidental death," commented that in his opinion the boy lost his life through sheer carelessness on someone's part in leaving a faulty cable joint open to anyone who might stand on it.

The boy's father described how he found his son lying in the middle of a field near an electric wire which passed under a "piece of tin."

An electrical engineer said that a potential of between 210 and 230 V existed between the metal shield over the joint and earth. The joint had been made by someone with some electrical knowledge but little or no skill or experience.

An R.A.F. officer said he understood that the Ministry of Works was responsible for the maintenance of cables, but he could not say on whom the ultimate responsibility lay.

Welder's Death.—While working as an electric welder at the works of George Turton, Platts & Co., Ltd., Sheffield, Herbert Gibbons, aged thirty-eight, received a fatal electric shock. Evidence was given that he was seen to put his foot on the pedal and his hand on a lever when sparks came from the machine, and he fell.

Albert Victor Neville, chief electrician, stated that the earth wire was off and there was a "short" between a regulator and a frame. Non-conducting material had been burnt away.

The coroner said he could only record a verdict of "Accidental death," but it was an accident which should never have happened. He was inclined to agree with Gibbons, who had told his wife that more precautions could be taken at the works. The evidence disclosed a very serious lack of check of the electrical apparatus.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Training for Higher Posts

MR. E. A. HILTON'S letter on this subject hits a nail that is often overlooked, namely, how did the men at present in the higher posts get their training?

I have no wish to decry specialised training but feel at the present moment much too much is expected of it. It does not automatically follow that because a man has been trained for administrative purposes he is, in fact, a good administrator. The facts are that the men *for* the higher posts in any walk of life are men with a flair for organisation and that usually means a good knowledge of, and deep interest in, human nature, because in the end all organisation is the planning of work for other human beings to carry out, and its success or failure will depend ultimately on the degree of human understanding shown in the planning. All the training in the world will not make an organiser of a man who must fiddle with small details or one who is afraid to delegate real authority.

This training complex is like the recurring fable that the business side of the supply industry should be the province of the secretaries or the accountants because they "understand business" and not the engineers! Actually the secretaries and the accountants are just as much tools in the organisation as are the engineers; they may be good business men or they may not, they may be good organisers or they may not, irrespective of what particular course of training they may have followed. And the same applies to engineers.

In brief, it is character and characteristics that are the essentials. Training will help, but it will not create. R.N.P.

M.I.E.E., A.M.Inst.C.E.

Undue Preference

IN his article on this subject in the *Electrical Review* of September 24th Mr. Dorey says that he does not challenge the equity of pre-war basic electricity tariffs for the respective users but he does challenge war-time increases in these tariffs because, as he shows by examples, these increases are not the same for all consumers and hence, in his opinion, Section 20 of the 1882 Act is contravened.

First, it is, I think, an incorrect interpretation of Section 20 to construe it as Mr. Dorey does to mean that a supply authority shall not *increase* its charges in such a way as to show any undue preference to any local authority, company, or person. The clause says nothing of the kind and such an interpretation cannot be imported into it. Hence upon the legal point taken by Mr. Dorey he is wrong.

Second, the pre-war basic electricity tariffs, which Mr. Dorey specifically states he does not challenge, differ widely as between various consumers for well-known reasons and hence the actual amount of, or the percentage war increases must also vary considerably for obvious reasons in order that they shall be equitable. Hence from the practical viewpoint Mr. Dorey is again wrong.

As Mr. Justice Sargent said in the Long Eaton case, quoted with approval by Mr. Justice Astbury in the Hackney case:—"Under each Section (Sections 19 and 20) I think that the whole circumstances may be considered from the broadest possible point of view and that one question is whether the circumstances affecting consumer A and consumer B in relation to their supply of power are substantially dissimilar or sufficiently dissimilar to justify broadly the differentiation proposed."

In accordance with this and in respect of war increases the electricity supply industry is in general faithfully discharging its obligations.

Gravesend. NORMAN ELLIOTT.

Power Engineers' Salaries

MAY I as a member of the E.P.E.A. be allowed, through the medium of your paper, to congratulate the National Association of Local Government Officers on its success in obtaining another increase after only about six months' negotiations.

Like all E.P.E.A. members I am wondering when our officials will awake from their slumbers and consider our welfare, but perhaps the time is not opportune. I seem to recall that an increase was debated for junior engineers and may have come into operation in August. Which August? Again the same old cry will emerge from St. George's Square: "The time is not opportune." Is the E.P.E.A. an association for employers or employees?

"Fairplay" in his letter in your issue of September 17th shows beyond any doubt that the E.P.E.A. has the interest of the A.M.E.E. at heart. This very same body which lives in the past has repeatedly rejected revision which would have been beneficial to our members. Can one wonder at the dissatisfaction shown at all section meetings?

STILL HOPEFUL.

Engineering Economics

Application of Interest Tables

DESIGN of plant to specific instructions to be constructed on site provided the subject of the second lecture given by Sir Frank Gill (on September 28th) in the University of London series on "Engineering Economics." As an illustration the case was considered in which a load had to be met by the installation of two capacities now and a third ultimately. The first cost of the addition would be 2·5 if constructed immediately and 6·5 if deferred (a fixed cost of 4 being incurred each time work was done). Annual charges in the three cases considered were 5, 7½ and 10 per cent. The ratio $\frac{2{\cdot}5}{6{\cdot}5}$ was 0·384, which was the present value of 1 for 20, 13 and 10 years, and if the addition would be needed within these years it should be made now.

Unit first costs and their ratings for annual charges were the foundations of the analysis. The former should include all items associated with it, each unit falling into a separate life class. The rate of return should be estimated if possible in conjunction with the owner, any cover for special risks preferably being kept distinct. Depreciation, which was required to replace capital invested and not the plant, had to provide for diminution in first cost of the plant during its physical life and also during its economic life; it was the latter that chiefly concerned the engineer. If the cost of recovering the plant would be more than the amount received for it, the negative residual value must be added to the sum to be reserved through depreciation. If the plant were taken out before its physical life was exhausted, the recovery must be treated separately, as the value might be much greater than the calculated "residual" value.

Sinking-fund Method

The only path by which the descent of the unamortised first cost from 100 per cent. to residual value could be calculated that was both accurate and gave convenient results for such purposes as framing tariffs was the sinking-fund method. Normally the same rate of interest should be used for depreciation as for first cost, but where a lower rate of interest was (illogically) allowed on depreciation reserves, the engineer should compute depreciation at the two rates and show the excess separately in order not to confuse a financial condition with an apparent shortening of life of the plant. Other annual charges would be expressed on the most suitable bases for the business concerned and not necessarily on first cost.

Papers containing supplementary data were distributed, thus providing material for "home-work" which, Sir Frank insisted, was necessary in order to acquire speed in the use of the interest tables. These papers included a contributed example of an application of engineering economics to alternative methods of rural distribution by cables and overhead lines. This analysis showed that while the first cost of the two cable schemes might be 60 to 70 per cent. more, there might be less than 12 per cent. difference in annual charges when worked out on a correct basis.

Red Cross Appeal

Fifteenth List

WE have received from the organisers of the Electrical Industries Red Cross Appeal a further list (the fifteenth) of covenanted subscriptions and donations received from organisations and individuals in the various branches of the electrical and radio industries. This is reproduced below.

In the thirteenth list (*Electrical Review*, August 13th, p. 198) there appeared the name "H. F. Truman Trading Co." This should have been the Truman Electrical Co.

Covenanted Subscriptions

	Gross Annual Amount £ s. d.
Brought forward ..	10,772 2 0
E. K. Cole, Ltd.	300 0 0
Harrogate Electricity Dept. ..	30 0 0
J. W. Gladwin & Sons, Ltd. ..	6 6 0
Electro Methods, Ltd.	5 5 0
Cyril W. Thompson	2 2 0
Total	£11,115 15 0

Donations

	£ s. d.
Brought forward ..	6,448 7 3
Winchester Electricity Dept. ..	5 5 0
Baxter & Impey, Ltd.	5 0 0
Bristol Selectric Circle	2 10 0
Garforth Radio Services, Ltd. ..	2 2 0
G. E. Smallwood & Co... ..	1 15 7
Total	£6,464 19 10

Parsons Memorial Lecture

Members of the Institution of Electrical Engineers are invited to attend a meeting of the Physical Society to be held at the Royal Institution, Albemarle Street, London, W., on Friday, October 15th, at 4.30 p.m., when the Parsons Memorial Lecture for 1943 will be delivered by Lord Rayleigh, F.R.S., who has taken as the subject of his lecture "Optical Topics, in part connected with Charles Parsons."

COMMERCE and INDUSTRY

Barrow Dispute Settled. Improved Copper Prospects

The Barrow Strike

LAST week the National Arbitration Tribunal issued its interpretation of the engineering wages award which it made last March. The award fixed new basic rates and stipulated that in the case of time allowances or premium bonus systems the bonus or basic time rates should be such as to enable a workman of average ability to earn at least 27½ per cent. more than the new basic rates. Members of the Amalgamated Engineering Union and other trade unions employed at the Barrow works of Vickers-Armstrongs claimed that as a higher bonus rate than 27½ per cent. had been earned on the former basic rates that higher rate should be maintained on the new basic rate. This contention is rejected by the Tribunal which points out that the award was intended to benefit the lower-paid men. An adjustment in the percentage is apparently justifiable only when the award rates for any particular man work out at a lower figure than the man was receiving for the same work before the award.

When the Tribunal's decision was made known the men declined to accept it and remained out until Monday last when, following an appeal by the Minister of Labour and an offer by the company, they decided to return to work.

The company's offer included an adjustment of the method of calculating the basis time for the premium bonus system upon the new base of 66s. per week and a promise to adjust basis time where the present basis times were such that men of average ability were unable to earn 27½ per cent. of the 66s. base rate. It was also proposed that the premium-bonus system should be replaced by a time-piece system if the workers desired it and this is to be the subject of negotiations between the company and the unions. Men who are unable for any reason to earn the time rate can be employed as plain time workers for the period of the war if they so desire. Those who are not employed on a straight payment-by-results system (charge hands, etc.) are to receive increases equivalent to those who are.

E.D.A. Area Conference

An area conference by E.D.A. is to be held at the Picton Hall, William Brown Street, Liverpool, on October 19th at 2.30 p.m. Mr. L. H. Keay, O.B.E., M.Arch. (L'pool), F.R.I.B.A., City Architect and Director of Housing, Liverpool, will speak under the title "Looking Ahead." The audience will include chairmen and chief engineers of electricity supply undertakings in the North-West England and North Wales area, together with chairmen and officials of Housing Committees and Post-War Reconstruction Committees, architects, and members of the E.A.W.

Valve Manufacturers' Association

At the recent annual general meeting of the British Iron and Steel Valve Manufacturers' Association held in London and presided over by Mr. O. E. Dickinson (Smith Bros. (Hyson), Ltd.), it was unanimously decided to extend the membership of the Association to include manufacturers of non-ferrous industrial type of valves and fittings and to alter the title of the Association to the British Valve Manufacturers' Association. Non-ferrous valve makers desirous of becoming members of the Association can obtain full particulars from the secretary, Mr. H. E. Jones, 32, Victoria Street, London, S.W.1.

Successful Sabotage

A great deal of damage, leading to much dislocation of production, was caused at the Creusot Works, France, recently by a well-co-ordinated plan for putting the electrical plant out of action prepared and executed by the French resistance movement. George Slocombe in the *Sunday Express* gives details of the scheme which was carried out by five parties. At Chalon-sur-Saone central station a transformer and several transmission towers were put out of action. Other parties went for transformer stations at Germoles and in three other positions. At the Schneider plant three large transformers were destroyed, and at Tournus the 120,000-V line linking the Chancy power station with the Schneider substation was cut.

The Copper Position

The latest report of the Combined Copper Committee recently published in Washington reports a narrowing of the gap between the production and consumption of copper foreseen by the Committee two months ago. Now it is stated that the new supply is approximately equal to the United Nations' actual consumption. The improvement is attributed primarily to the better shipping position; the sinking of copper-carrying ships has not been so heavy as was anticipated. In addition the collection of scrap in the United States is exceeding expectations and the shipment of copper from Africa has been speeded up.

A reduction in consumption has been effected by the substitution of steel for copper in shell cases. It is stressed by the Committee that this satisfactory position can only be maintained by a continuance of the present rate of production, collection of scrap and reduction in the use of copper in shell manufacture.

Standard Traction Pillars

A specification and drawings are now available for the design and construction of feeder and section pillars on tramway and trolley-bus systems; these have been prepared by the Joint Overhead Equipment Committee of the Municipal Passenger Transport Association (Incorporated) and the Public Transport Association Incorporated, which include in their memberships all the public tramway and trolley-bus systems in Great Britain and Northern Ireland. In the absence of standards manufacturers have previously been called upon to supply a wide variety of types and arrangements to meet individual preferences.

The new recommendations take into account

the possibilities of post-war developments; *e.g.*, conversion of tramways to trolley-bus systems or new route constructions. They provide both the operators and manufacturers with a broad measure of standardisation. The drawings illustrate constructions which conform to the recommendations and have been found satisfactory over many years; reasonable variations can be made, within the measure of standardisation indicated, to suit local needs.

Copies of the specification and drawings may be obtained from either of the Association secretaries at 2s. 6d. each, post free; the prices of the three drawings are available on application.

Hull Town Planning Exhibition

The Hull Corporation recently staged a comprehensive Town Planning Exhibition in the Mortimer Galleries at the City Hall. The exhibition was opened by Professor P. Abercrombie who, with Sir Edwin Lutyens, has been commissioned to prepare a scheme for the replanning and reconstruction of the City and County of Kingston-upon-Hull. The various sections of the exhibition included exhibits lent to the Corporation by Cadbury Bros., Ltd., the Hull Regional Survey, the city architect's section, the city engineer's section and displays by the Corporation Electricity Department and the East Hull Gas Co.

The purpose of the exhibit of the Electricity Department was to emphasise first the necessity for all houses to have efficiently planned kitchens and planned laundries, the designing of the kitchen to rest on the correct relationship of the three functions—cooking, washing up and vegetable preparation, and food storage and preservation.

A planned kitchen at Hull Town Planning Exhibition

A number of fundamental features of design were stressed such as working tables being of standard height, oven and refrigerator to be mounted at table height, and the largest possible window space. The effect of the correct planning of the three functions was illustrated by two motion study charts showing that a simple meal prepared in an unplanned kitchen took eighteen minutes or a distance walked of 199 ft. whereas the same meal in a planned kitchen took eleven minutes or a distance walked of 55 ft. The accompanying illustration shows the attractive lay-out of the kitchen, part of which (altered to suit the local scheme) was lent by Poplar Electricity Department.

"Declassified" Engineers' Service

Members of the Electrical Power Engineers' Association have complained that when their undertakings have been put into a lower classification under the National Joint Board Schedule their salaries have been reduced to the amount applicable to the first year of service in the new class. This has now been remedied by the National Joint Board by means of an amendment of Clause 35, which now stipulates that "an employee in a station, substation or undertaking which is reduced to a lower classification shall have his period of service in the higher classification added to his previous period of service in the lower classification when determining the column to which he shall be allocated in the lower classification."

Brassfounders' Change of Name

At the quarterly general meeting of the Brassfounders' Employers' Association on September 21st it was decided to alter that body's title to the National Brassfoundry Association. The change will take effect from January 1st next. The Association was formed primarily to deal with wage questions; now it covers a much wider field in its service to members.

Factory Lighting Installation

Some difficult lighting problems were encountered in a recent factory installation and to overcome these full advantage was taken of the special features of the fluorescent tubular lamp. The particular part of the works concerned was in the basement of a building, with no natural light, so that whatever system was installed had to be good enough to allow work to proceed continually under artificial light with no sense of enclosure or inadequacy due to the lack of daylight. The ceiling was only 10 ft. high and the presence of numerous girders, trunks and pipes complicated the placing of the lighting units. Furthermore, the work was of an exacting nature, requiring operations within fine limits, so that it was essential to provide a good value of illumination well directed to reach the working points.

The problem was eventually solved by employing Benjamin Electric "Flurolier" reflectors mounted close to the ceiling and so arrayed that the maximum advantage was taken of the diffusion provided. The arrangement of the machines in regular rows enabled the lighting to be arranged also in rows averaging about 8 ft. apart. In one section a double row of multiple drills faced one another and here the lighting was provided by two rows of "Flurolier" units mounted down each side of a central beam. The light colour of the surroundings helped to preserve a bright

appearance and, combined with the colour of the light, prevented the absence of daylight being felt as a handicap. The lighting scheme was prepared by the Benjamin Electric, Ltd., and in addition to several hundred "Flurolier" reflectors, included "Saaflux RLM" reflectors in storage areas.

London Gas Co-ordination

Under the auspices of the South Metropolitan, South Suburban and Wandsworth Gas Companies a new company with the title "Greater South London Gas Corporation" has been registered. Its objects are to co-ordinate policy and further the development of the interests of the three companies which, however, will retain their identity and individuality.

The companies serve an area of 435 sq. miles with a population approaching 3,000,000 and own about 4,500 miles of mains. It is expected that among the matters to be dealt with by the new corporation will be the purchase of raw materials, the bulk supply of gas and the working up and disposal of by-products.

Heat-Treatment Furnaces

In the article on "Heat Treatment" in our issue for September 24th it was stated that the furnaces mentioned were of Wild-Barfield manufacture. We are, however, informed by G.W.B. Electric Furnaces, Ltd., that the ageing furnace illustrated on page 400 and described on page 401 was manufactured and supplied by them.

Undertakings' Fuel Returns

The Ministry of Fuel and Power (Information) Order, 1943 (S.R. & O. 1943 No. 1358, Stationery Office, 2d.) which was made on September 10th, requires mine owners and undertakings involving the production, handling, transport and use of fuel to make periodical returns. In the case of electricity supply undertakings the information required includes weekly particulars of deliveries and stocks of coal and coke, the number of loaded and empty wagons at works sidings, and the name of every coal-field from which coal is received.

Lighting at a Flag-making Centre

The enlargement of the various Services has made many demands on industry among which is included the supply of flags for all purposes. As a consequence of this, the well-known flag-making centre of Porter Bros., Liverpool, is now working to capacity. The sewing of coloured materials can be very trying to the eyes where contrast is of low order. Such conditions occur to a marked extent in this particular case, and tungsten filament lighting tended to reduce the contrast from that of daylight. John Hunter & Co., electrical contractors of Liverpool, under the supervision of Mr. J. J. Wilson, therefore carried out a new lighting installation using Crompton 80-W, 5-ft. fluorescent tubes to replace the clear tungsten lamps in various forms of shades. Forty "C.P. 377" troughs with integral gear were used in the new installation, the total wattage being 3,200.

The arrangement of the new system was such that a reasonable cut-off was obtained at all angles of vision approaching the horizontal and with the low surface brightness of the tube a considerable improvement was obtained in appearance of the working area with a resultant drop in eye-strain and the total removal of glare. These results are apparent in the reaction and general health of the machinists, coupled with a material increase in production. The intensity over the working area, after a settling down period to allow for normal depreciation of lamps and lighting units, is 17·5 ft.-candles. This is achieved with an electricity consumption not exceeding that of the old installation.

TRADE MARK APPLICATIONS

THE following applications have been made for British trade marks. Objections may be entered within a month of September 22nd:—

EFE (design). No. B621,321. Class 9. Electric switches, electric switch sockets and electric plugs.—E. F. Engineering Products, Ltd., Harford House, Carey Place, Watford, Herts.

GENTIM. No. B623,763. Class 9. Signalling, time recording, and telephonic apparatus.—General Signal & Time Systems, Ltd., Autophone House, 73, Great Peter Street, London, S.W.1. To be associated with No. B623,764 (3,417) xiv.

LAMBAK. No. 623,774. Class 1. Laminated materials, composed of thermo-setting or thermoplastic mouldable materials with a textile or paper base, in the form of rods, sheets, strips, or tubes, and other similar shaped pieces, for use in manufactures. No. 623,909. Class 9. Parts (not included in other classes) of electrical apparatus and instruments. To be associated with No. 623,911 and others. No. 623,911. Class 17. Electrical insulating materials and electrical insulation parts made therefrom.—Redfern's Rubber Works, Ltd., Dawson Street and Springbank Street, Hyde, Cheshire. To be associated with No. 623,774 and others.

DINSTAL. No. 623,790. Class 10. Infra-red-ray apparatus and lamps for use therein, electro-therapeutic instruments and apparatus, and parts (not included in other classes) of all the said goods; all for surgical, medical, dental or veterinary purposes.—Modinstal Electric Co., Ltd., Oldham Works, Oldham Terrace, Acton, London, W.3.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

PULSOCON equipment for treatment of joint troubles by means of rubber pads.

War Load in Canada

Expansion of the Ontario Hydro-electric System

SINCE the beginning of the war more than $50,000,000 has been spent on new construction by the Hydro-electric Power Commission of Ontario. Even so, such has been the growth of wartime industrial activity that a shortage of power capacity developed last year, and measures akin to those adopted in this country were introduced to curtail consumption in less vital directions. As part of a campaign to secure voluntary economy, a number of striking advertisements carried an appeal for power conservation to all domestic and commercial consumers, whose response was such that the load conditions of last winter were met without serious difficulty.

The story of this growth of war load and the way it has been met is told in the Commission's annual reports for 1941 and 1942 which we have recently received. In a foreword to the latest of these Dr. T. H. Hogg, the chairman and chief engineer, records that in one city alone six large electric arc furnaces for the production of steel were installed during 1942. In the industrial cities of south-western Ontario, served by the Niagara system, there was a substantial increase in the load requirements of the electro-chemical and electro-metallurgical industries, steel production facilities, aircraft assembly plants and factories manufacturing aircraft parts, together with such allied activities as the production of coke, special forms of steel, non-ferrous alloys, etc.

Power for Shipbuilding

One industry that has assumed great importance is the manufacture of bronze propellers for the expanding shipbuilding programme and these are now being made in a city served by the Georgian Bay system, in whose area there are also shipbuilding yards. In the region supplied by the Eastern Ontario system a number of new industries have been started. An aluminium fabricating plant, equipped with large electric annealing ovens, is producing castings and extruded shapes in large volume. Another new industry is the production of magnesium from dolomite by electric furnace methods. In magnesium Canada is now able to supply more than her own requirements.

Throughout its vast territory of 363,282 sq. miles, more than four times the area of Great Britain, the Commission supplied 10,466 million kWh in 1941 (an increase of 8·1 per cent. on the previous year) and 11,674 million kWh in 1942 (11·5 per cent. increase), which exceeded all previous records. The increase in output for primary purposes was even more marked (by 20 per cent. to 10,690 million kWh in 1942). In the winter of 1941-42 the aggregate peak load was 2,349,824 HP, the primary peak load being 2,202,612 HP against 1,864,487 HP.

The chief constructional activities of the Commission last year included the Ogoki diversion (completed during the past summer), the building of a submerged weir across the Niagara River, power developments at Barrett Chute and DeCew Falls, and the Bark Lake storage dam. The Barrett Chute development (54,000 HP, gross head 154 ft.) and Bark Lake Dam on the Madawaska River were completed last year and the DeCew Falls project (65,000 HP unit operating under a head of 265 ft.) was due to be completed during the past summer.

Ottawa River Development

A large new scheme is foreshadowed by an agreement between the provinces of Ontario and Quebec relating to power sites on the Ottawa River. The largest site to be allocated to Ontario is that at Des Joachims where, under a head of 135 ft., an initial development of about 300,000 HP is practicable, with an ultimate installation of possibly 400,000 HP. The Commission turned to the Ottawa River as a source of additional power when it became apparent that the St. Lawrence project could not be counted upon in the near future.

In the field of transmission, it is stated that the capacity of the new transformer station at Burlington is being increased by 50 per cent. and a 120,000-kVA synchronous condenser has been purchased for installation during the present year. This transformer station was placed in service in 1941, when two banks of three 25,000-kVA, 220/110-kV units were installed, with a third bank on order. The transformers, each weighing 225 tons, are among the largest in Canada. In the same year a single-circuit transmission line 275 miles long was completed from the Quebec-Ontario boundary to Toronto, with a 45-mile double-circuit line on to Burlington. During 1941 altogether 515 miles of 44- to 220-kV transmission circuits and 850 miles of rural primary circuits were constructed. Last year work of this kind was on a reduced scale, with 65 miles of transmission circuits and 43 miles of rural feeders erected.

In the two years the Commission's total revenue was $43,596,090 and $48,590,812 respectively, with expenditure standing at $42,912,901 and $47,906,332, leaving net surpluses of $683,189 and $684,480.

Capacitor Effects

Generator Action in Motors

By V. Mayer,
A.M.I.E.E.

THE connection of capacitors for power-factor improvement in circuit with induction motors (thus obviating the need for separate switchgear and discharge resistances) is a commendable practice, but it is not without its pitfalls for the unwary. It is usually less economical to correct the power factor of individual motors than to connect capacitors to a few larger key motors. The capacitor current is therefore frequently as much as or more than the magnetising current of the associated motor. Such a motor when disconnected from the mains and driven mechanically will act as a generator, building up its voltage like a shunt dynamo, the capacitor receiving its first charge from the residual magnetism of the motor iron. In practice this often occurs while motors are slowing down after being switched off. In more than half the cases I have tested the free generated voltage has risen to above mains voltage before dropping as the speed falls after switching off. The generated frequency will depend primarily on the speed of rotation.

The risk of insulation breakdown is greater than may first appear. If, for example, the fuses melt in phases A and B (fig. 1) feeding a three-phase 400-V motor and the machine generates 570 V, as some did, then insulation intended for 230 V to earth is subjected to 800 V. This occurs when the free generated voltage wave at decreasing frequency coincides with the supply voltage wave of steady frequency between neutral and phase C, with which it is now in series. The no-volt trip in the starter provides no protection because the coil continues to be energised by the generated voltage. A reversing switch might give the same results unless connected between motor and capacitor.

If the two melted fuses, or other supply interruption, are on a main circuit which also feeds 230-V lighting, the lamps may also receive anything up to 800 V, unless sufficient other apparatus is connected to the circuit to prevent this effect. Circuit-breakers which open all phases simultaneously are, therefore, preferable to fuses

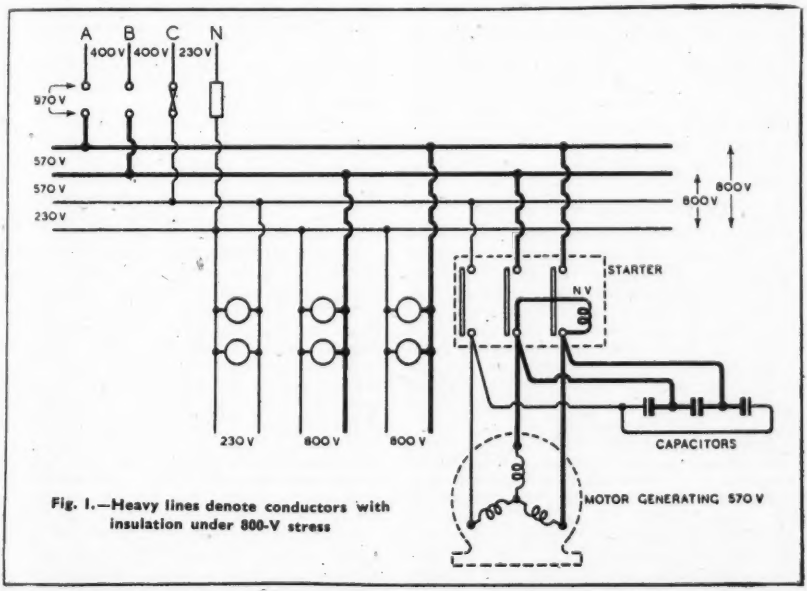


Fig. 1.—Heavy lines denote conductors with insulation under 800-V stress

in such cases; they should be set to trip before any main fuses can blow.

When switching the motor off and then on again quickly, as, for example, in moving a star-delta or auto-transformer starter into the "run" position, what happens will depend on the relative positions of the two voltage waves at the moment of reconnection. Sometimes there is a violent electrical and mechanical kick. With rigid coupling to driven plant possessing momentum, the mechanical kick is liable to cause damage. In one case, the shaft of a 40-HP motor with auto-transformer starter was broken, and in another the shaft was twisted. The feature of the twisted shaft which threw suspicion on the capacitor was that the twist was backward, as if the motor had seized (which it had not) and the momentum of the driven plant had caused the twist.

As a check on the direction and magnitude of the mechanical forces, a weighted bar was pivoted at its centre about the shaft axis and secured by the pivot to the shaft end of a 28-HP motor. A spring and friction disc were used to make the bar rotate, like a propeller, with the shaft; a deflection of 90 deg. of the bar was allowed in each direction, the maximum value being recorded by two light pointers, one on each side of the bar. The motor ran freely on ball bearings and consequently a normal start followed by unaided retardation produced a slight deflection on the forward scale only, due to the acceleration. The switch could be opened and reclosed after the motor had attained speed without any difference from a normal start being recorded.

Capacitor Connection Results

When 15-kVA capacitors were connected a normal start and stop produced identical results, but opening and reclosing the switch caused a deflection of both pointers. The force of the kicks varied immensely and they were nearly always much greater than in normal operation. An interesting point was that when the rotor came to rest the friction-damped rod was always in contact with the forward pointer, indicating that the last kick was with rotation.

Friction on the bar was next so increased that only the most violent kicks would move it. All the kicks then recorded were with rotation, confirming the evidence of the twisted shaft. It is evident that on reconnecting with the supply there were at least two distinct kicks, one in each direction, the last always being with rotation and liable to be violent. Slip-ring motors would not be subjected to this breaking and re-making of the supply, except on account of loose connections or faulty contactors.

It would appear that capacitors used in conjunction with starters which momentarily pass through a neutral position should be in circuit only in the "run" position unless too small to cause appreciable generation. This is particularly important if the load is rigidly coupled to the motor.

In another example, blown fuses for a 30-kVA star-delta capacitor were replaced after instruments had been connected in circuit. When the starter was held in the "star" position the associated 59-HP motor, when nearly up to speed, commenced rumbling and vibrating without exceeding that speed. At the same time the 8-A line current was increased fourfold, while the current in the windings rose from 6·6 to 90 A, the capacitor current from 14·5 to 80 A in each bank and the voltage between each line and star point from 230 to 500 V.

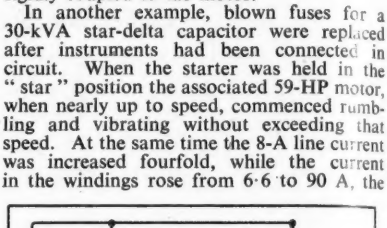


Fig. 2.—At a certain speed the resultant of the three currents between X and Y is a very heavy current at about 135 cycles

Conditions immediately returned to normal when the starter was put in the "run" position. Occasionally the machine accelerated past the critical speed without trouble and would then run normally in star unless it was slowed down again to that particular speed.

The explanation that follows is offered tentatively, in the hope that it will be confirmed or corrected by others. Oscillograph and other tests were made on another machine (fig. 2) with various capacitor ratings. It was found that similar abnormal conditions arise at the critical speed when running as a capacitor-excited induction generator on open circuit, provided the capacitors and windings are star-connected with their star joints joined, as with star-delta starters. If the joint between the star points is broken, conditions are immediately restored to normal whether the machine is working as a generator or motor.

At the critical speed each of the three-phase currents between the capacitor and winding develops a third harmonic which becomes greater than the fundamental wave. The three harmonics or triple-frequency waves are in phase with one another, so that a very heavy current of three times the generator frequency passes along a conductor joining the two star points. On one occasion 150 A was measured in this con-

ductor compared with only 2·3 A for the motor without capacitors.

On joining the three line terminals, the machine becomes virtually a single-phase induction generator with the phases forming three parallel paths and with three times the original frequency. As these terminals are not joined in operation, there is normally a stronger tendency for a rotating flux to form, and for three-phase current to be generated at the basic frequency. It would appear, however, that the critical speed at which the triple frequency develops coincides with the resonant frequency of the circuits closed by the star points. This natural frequency does not increase with the speed of rotation as does the induction generator frequency and its harmonics, so they can only correspond at the one speed. Larger capacities giving lower resonant frequencies certainly did reduce the critical speed, both as a motor and as a generator.

It was proved that, for a motor, the excessive currents and voltages were three times the generator frequency and less than 150 cycles. Obviously, the three outer terminals are held at mains voltage and frequency, thus preventing the generation of normal three-phase current, but when resonant conditions arise in step with an independent series of impulses there is no longer anything to prevent the star point becoming unstable and the triple-frequency values accumulating.

In practice, a motor is not held for long in the star position and possibly the abnormal conditions would cause no harm if heavy fuses are used, but with a star-delta starter there is also the risk of mechanical damage, so that it would appear best to avoid this type of connection where generation is possible. The capacitors can be provided with discharge resistances and connected permanently in delta to the three-phase ends of the windings, so that they are not in circuit during starting. This eliminates all but the high-voltage risk.

Practical tests are the surest way of proving if a machine generates when the switch is opened, but one can feel confident that it will not do so to any serious extent if the capacitor current is well below the motor no-load current. It may not be thought necessary to eliminate all risk of it occurring on machines which are not subjected to intermittent breaking of the supply and do not rely on fuses for protection. Where generation could be serious, however, it might be best to connect the capacitors differently if their current exceeds, say, 30 per cent. of the motor no-load current. Nothing in this article is intended in any way to discourage the use of capacitors for power-factor correction.

Radio Aerial Systems

Machine for Calculating Polar Diagrams

A MACHINE for calculating the polar diagrams of radio antenna systems, which enables tedious computation, ordinarily needing a whole day, to be performed in fifteen minutes, is described in the American journal *Electrical Communication* by Dr. H. Paul Williams (Standard Telephones & Cables, Ltd., England) who designed it three years ago. The machine, which has been in constant service for about two years, avoids the plotting of some dozens of curves of which only a few may eventually be found useful. In its present form it will determine the polar diagram appropriate to as many as five antennæ situated anywhere within a circle of four wavelengths diameter, while the several currents in the respective antennæ may be of any relative phases and magnitudes.

The exploring angle is read off from a dial marked in degrees and the corresponding relative amplitudes are shown directly on a voltmeter. When once the machine has been properly set up it is incapable of errors, which feature is quite as important as the saving of time; also it makes it practicable to consider a larger number of design variations the working-out time of which would otherwise be prohibitive. As few or as many readings as one likes may be obtained and the handle may be turned backward to a previous value if required.

The present model caters for five antennæ, but the principle of operation could be extended to any number and, moreover, the system could be easily refined for automatically tracing out polar curves. The apparatus is composed of "Selsyn" machines, which are utilised as transformers rather than motors. When a number of them are connected with their primary windings (three-phase stators) in parallel, the phases of their secondary (single-phase rotors) voltages will be determined by the angular positions of the individual rotors, which are not allowed to revolve in the normal way, but are restrained in certain angular positions representing the phases of the received voltage components. A potentiometer across each secondary enables the magnitude of each voltage vector to be adjusted to correspond to a given antenna current. Also, with all secondaries connected in series, measurement of the total voltage with a high-impedance voltmeter will indicate the vector sum of all the secondary voltages.

Choosing one antenna as the reference point and assuming it to represent zero phase enables four motors to be used for five antenna calculations. The machine has also proved itself of great "inverse" utility, for determining the current and phase relationships of an antenna system when the polar pattern (as measured in the field) differs from what theory predicts due to the antennæ not being fed in the desired way, which may easily happen when the mutual antenna impedances are not all known.

ELECTRICITY SUPPLY

Barnstaple Increase Banned. Hull Extensions

Ardrossan (Ayrshire).—POST-WAR STREET LIGHTING.—The Council is to discuss the question of changing from gas to electric street lighting. The mover of the recommendation at the last meeting of the Council said that he wanted to see the town lighted by electricity, " with the modern technique of floodlighting."

Barnstaple.—PRICE INCREASE APPLICATION REJECTED.—It was reported at a meeting of the Town Council on September 28th that the Electricity Commissioners had refused the request of the Council for permission to increase electricity charges.

In a letter to the Council the Commissioners pointed out that, from the particulars submitted with the application it appeared that the estimated deficiency for 1943-44, would reduce the appropriation account balance to £7,671 at March 31st, 1944, and leave the reserve fund untouched. The Minister of Fuel and Power took the view that, while it was not intended that reserves should be wholly wiped out, they should be used to a certain extent to meet deficiencies.

Eccles.—COMPLETION OF CHANGE-OVER.—The borough electrical engineer (Mr. C. V. Johnson) recently submitted proposals to the Electricity Committee for the completion, in two sections, of the scheme for the changeover to the three-phase AC system, the first stage to be undertaken forthwith and the second after the war. Since 1929, when the scheme was begun, 97 per cent. of the consumers' installations have been changed over.

The question has now arisen whether it might not be advisable, in the interests of economy at least, to complete the scheme forthwith. The annual consumption of the non-standard section amounted to only 1 per cent. of the total energy sold and the transformation losses on the obsolete single-phase system were out of all proportion to the annual consumption of these consumers. Furthermore, the elimination of the system would be equivalent to a saving of 100 tons of coal per annum.

The first stage, which was of a temporary character, involved the re-energising of the old single-phase low-voltage mains at 230 V by connecting them with the standard three-phase system, thus allowing the whole of the 6,600/2,000-V transformer banks at the Cawdor Street and Corporation Road substations and the various 2,000/200-V transformer units to be taken out of circuit, dismantled and sold, with a consequent saving of transformer losses of 200,000 kWh per annum. The second stage would involve the laying of new three-phase mains, relaying of services, and the provision of substation equipment and the costs in both cases amounted to £993 and £2,500 respectively. The Committee adopted these proposals.

Hereford.—OVERHEAD LINE.—The Corporation has agreed to a proposal of the S.W.S. Electric Power Co. to erect an overhead line at Canal Wharf.

Hull.—POWER STATION EXTENSIONS.—Mr. D. Bellamy, general manager of the Electricity Department, has been authorised to take preliminary steps to provide additional plant, estimated to cost £750,000, at the power station. The extensions are to be completed by September, 1948.

UNDERTAKING'S FINANCES.—Mr. Bellamy reported that the Department, after meeting war-time increases in the cost of fuel (48 per cent.), labour (25 per cent.) and other materials (46¼ per cent.) and reducing the sinking fund, had made a net profit for the past year. This satisfactory position had been achieved with electricity supplied to the public at the pre-war price, plus 5 per cent. only. Industrial users had met a proportion of the total increased costs by the operation of the coal clauses in their agreements. The chairman, Mr. T. R. Broadbent, said they had achieved an outstanding result in a difficult year.

Leicester.—STREET LIGHTING PREPARATIONS.—The Corporation has decided to spend £4,235 in purchasing lamps and other street-lighting accessories so that normal lighting can be restored as quickly as possible when permissible.

London.—CONDITION OF CONDENSER TUBES.—At a meeting of the Battersea Electricity Committee the general manager reported that organic growth was being experienced on the condenser tubes at the power station, causing loss of efficiency and necessitating frequent cleaning. In order to prevent this growth he suggested the installation of chlorine injection apparatus at an approximate cost of £500. He was authorised to obtain such apparatus, second-hand if possible.

It was also reported that two tubes in the rear Bailey furnace wall of a boiler had burst, but fortunately no one was injured. Repairs are to be undertaken at a cost of £2,000.

Morecambe.—COOKER HIRE-PURCHASE.—The Electricity Committee has extended hire-purchase facilities in respect of cookers on a restricted basis for a two-year term. This decision was taken after the borough electrical engineer had reported that he expected to receive a few cookers with some regularity from the makers and that the appliances would be of standard type and reserved for consumers really in need.

EFFECT OF INCOME TAX DECISION.—In consequence of the judgment in favour of local authorities in the South Shields test case the Committee has been able to utilise a sum of £12,000 as reserve for capital expenditure.

MAINS EXTENSIONS.—The Committee is to extend mains to Sunderland Point at a cost of £150 and to Trumley House farm (£45).

Rawtenstall.—STREET LIGHTING.—The Corporation has asked the Lighting Committee to consider the extension of " starlighting."

Scotland.—PRESERVATION OF AMENITIES.—The Amenity and Fisheries Committees appointed under the Hydro-Electric (Scotland) Act held their first meeting at Edinburgh recently. The Secretary of State for Scotland explained that the Committees had been appointed for the purpose of giving advice and

assistance to him and to the North of Scotland Hydro-Electric Board on matters connected with the preservation of natural amenities and objects of architectural and historical interest, and the protection, as far as possible, of fisheries. The Committees must be consulted by the Board both before and during the preparation of a constructional scheme. They may be consulted at any other time, and may make recommendations at any time. The Board and the two Committees, he said, should regard themselves as collaborators in a joint enterprise, and should work in the closest accord. The Committees were then introduced to the Board, and welcomed on the Board's behalf by Lord Airlie, chairman.

South Shields.—METER REPLACEMENT.—The borough electrical engineer (Mr. G. H. Dale) has reported to the Town Council on the replacement of two-coil electricity meters which do not comply with the provisions of the Electricity Supply Meters Act, 1936. He stated that £4,000 had been included in the accounts of the electricity undertaking during the past five years to cover this work, which was estimated to take ten years, but suggested that for the remainder of the war no further amounts should be charged against the electricity accounts.

Swinton and Pendlebury.—LOANS.—Application is being made by the Electricity Committee for permission to borrow £300 for mains and services and £944 for workshop and stores extension.

York.—DOMESTIC APPARATUS IN NEW HOUSES.—The Housing Committee has recommended that in new housing schemes there should be provision for refrigerators and an electrically heated drying cabinet in each house, and that tenants should not be entirely dependent on the coal fire to provide hot water, for which purpose there should be immersion heaters thermostatically controlled.

Forthcoming Events

Institution of Electrical Engineers.—*Wireless Section.*—Wednesday, October 13th, 5.30 p.m. Mr. T. E. Goldup's inaugural address.

Installations Section.—Thursday, October 14th, 5.30 p.m. Inaugural address of Mr. A. G. Ramsey.

North-Western Centre.—Saturday, October 9th, 2.30 p.m. Engineers' Club, Albert Square, Manchester. Chairman's address. *Wireless Group.*—Friday, October 15th, 6 p.m. Engineers' Club. Paper: "Wave Guides in Electrical Communication," by Mr. J. Kemp. *Students' Section.*—Saturday, October 16th, 1.15 p.m. Engineers' Club. Luncheon to be followed at 2.30 p.m. by address by the chairman, Mr. H. C. Parker, on "Is There a Future for Graduates in Synchronous Machine Design?"

North-Eastern Centre.—Monday, October 11th. Neville Hall, Westgate Road, Newcastle-on-Tyne. Chairman's address.

Western Centre.—Monday, October 11th, 5 p.m. (tea 4.15 p.m.). South Wales Institute of Engineers, Park Place, Cardiff. Chairman's inaugural address.

Scottish Centre.—Tuesday, October 12th, 6.15 p.m. Royal Technical College, George Street, Glasgow. Chairman's inaugural address. Wednesday, October 13th, 6 p.m. Heriot-Watt College, Edinburgh. Repeat of chairman's address.

North Midland Centre.—Tuesday, October 12th, 6 p.m. Great Northern Hotel, Wellington Street, Leeds. Chairman's inaugural address.

South Midland Centre.—Saturday, October 16th, 12.30 for 1 p.m. Grand Hotel, Birmingham. Wartime lunch (at which the President, Col. Sir A. Stanley Angwin has promised to speak), and the Centre chairman's address.

South Midlands Students' Section.—Friday, October 15th, 6.30 p.m. Loughborough College. Paper: "Turbo-alternator Ventilation," by Mr. H. R. Ogle.

London Students' Section.—Monday, October 18th, 7 p.m. "Brains Trust."

Association of Mining Electrical and Mechanical Engineers.—*West of Scotland Branch.*—Saturday, October 9th. Question night.

Electrical Power Engineers' Association.—*London Local Technical Group.*—Monday, October 11th, 6.30 p.m. Livingstone Hall, Broadway, Westminster, S.W.1. Special open meeting to discuss the Association's proposals on "Post-war Planning for the Electricity Supply Industry." Chairman, Mr. G. M. Sichell, B.Sc. (Eng.), A.M.I.E.E. Mr. W. J. Oswald, A.M.I.E.E., will open the discussion.

Illuminating Engineering Society.—Tuesday, October 12th, 5 p.m. E.L.M.A. Lighting Service Bureau, Savoy Hill, London, W.C.2. Paper: "The Design and Application of Fittings for Fluorescent Lamps," by Mr. W. R. Stevens, B.Sc.

Institute of Transport.—Tuesday, October 12th, 5 p.m. Institution of Electrical Engineers, Savoy Place, London, W.C.2. Presidential address by Sir William Wood.

Institute of Welding.—Wednesday, October 13th, 5.30 p.m. Conway Hall, Red Lion Square, Holborn, W.C.1. Paper: "Some Aspects of Machine Design," by Mr. E. Hassler.

Institute of Fuel.—Thursday, October 14th, 12.30 for 1 p.m. Connaught Rooms, Kingsway, W.C.2. Annual luncheon followed at 2.30 p.m. by the annual meeting of members.

Diesel Engine Users' Association.—Thursday, October 14th, 2.30 p.m. Central Hall, Westminster, S.W.1. Discussion on the Heavy-Oil Engine Working Costs Report, 1941-42.

Iron and Steel Institute.—Thursday, October 14th, 11 a.m. 4, Grosvenor Gardens, London, S.W.1. Autumn general meeting.

Derby Society of Engineers.—Monday, October 11th, 6.30 p.m. School of Arts Lecture Theatre, Green Lane. Opening meeting and presidential address.

Nottingham Society of Engineers.—Monday, October 18th, 6 p.m. Corporation Gas Showrooms. Annual general meeting.

Birmingham Electric Club.—Monday, October 18th. Paper: "Air-blast Circuit-breakers," by Mr. A. R. Blandford, M.I.E.E.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

British Industrial Plastics, Ltd., has entered into an arrangement with Elliotts & Australian Drug Pty., Ltd., whereby a company will be formed in Australia (Beetle Elliott Pty., Ltd.) to manufacture "Beetle" cements, resins and moulding powders. The shares will be held in equal parts by the two founder companies. Another agreement has been made with Associated Insulation Products, Ltd. (parent company of Micanite & Insulators, Ltd.) for the fusion of interests in the production of synthetic adhesives.

The Renold & Coventry Chain Co., Ltd., reports a net profit for the year to June 27th, of £97,461, as compared with £100,729 for the preceding year. The final dividend is 7 per cent., again making 10 per cent., less tax, for the year.

Murex, Ltd., proposes to pay a final dividend on the ordinary stock of 10 per cent. and a cash bonus of 2½ per cent., maintaining the distribution for the year at 20 per cent., less tax.

Cable & Wireless (Holding), Ltd., announces the payment of a dividend on the preference stock of 2¾ per cent., less tax, for the half-year ended June 30th, last.

Cable & Wireless, Ltd., is paying an unchanged interim dividend of 1½ per cent.

Marconi's Wireless Telegraph Co., Ltd., has announced an interim dividend of 3½ per cent. (unchanged).

The Marconi International Marine Communications Co., Ltd., proposes to pay an interim dividend of 2½ per cent., less tax (same).

Richardsons, Westgarth & Co., Ltd., will redeem at 105 per cent. on December 31st, the then outstanding balance of 5½ per cent. first mortgage debenture stock.

Herbert Morris, Ltd., announce the payment of a final ordinary dividend of 15 per cent., free of tax, again making 20 per cent. for the year.

The Hoffmann Manufacturing Co., Ltd., is again paying an interim ordinary dividend of 7½ per cent., tax free.

Erinoid, Ltd., has declared a dividend of 10 per cent. on the ordinary shares for the year to July 31st (unchanged).

The Telephone & General Trust, Ltd., is maintaining its interim dividend at 3 per cent.

The London Power Co., is to draw £750,000 5 per cent. redeemable debenture stock on October 20th next for redemption at par on December 31st.

The Shropshire, Worcestershire & Staffordshire Electric Power Co. has announced unchanged interim dividends of 4 per cent. on the "A" ordinary, and 2½ per cent. on the "B" ordinary.

The South Wales Electric Power Co. has declared an interim ordinary dividend of 2 per cent. (same).

The Wessex Electricity Co., Ltd., is repeating its interim ordinary dividend of 1½ per cent.

The Woking Electric Supply Co., Ltd., is again paying an interim dividend of 3 per cent., free of tax.

The Salisbury Electric Light & Supply Co., Ltd., has announced an unchanged interim dividend of 4 per cent.

The Urban Electric Supply Co., Ltd., is again paying an interim ordinary dividend of 4 per cent.

The Jerusalem Electric & Public Service Corporation, Ltd., reports a net revenue for the year to March 31st of £77,551, as compared with £67,267 for the preceding year. The dividend on the ordinary shares is maintained at 5 per cent., less tax.

The Brazilian Traction, Light & Power Co., has declared a dividend of $1 per share, against 60 c. last year, making a total of $1·75 for 1942, as compared with $1 for 1941. The earnings are reported to have reached $2·28 per ordinary share.

The River Plate Electricity & Other Securities Corporation, Ltd., is paying an interim ordinary dividend of 2 per cent. (unchanged).

The Nigerian Electricity Supply Corporation, Ltd., announces a final dividend of 5 per cent., maintaining the distribution for the year at 8 per cent.

The Shawinigan Water & Power Co., is paying a quarterly dividend to September 30th, of 22 cents. (unchanged) on the common shares.

The Quebec Power Co. is paying a quarterly dividend of 25s. per common share for the period to September 30th.

Aron Electricity Meter, Ltd., is again raising its dividend on the ordinary shares, which last year was increased from 7½ to 10 per cent. A distribution of 15 per cent. is now announced.

W. T. Henley's Telegraph Works Co., Ltd., is paying an interim dividend of 5 per cent., the same as last year.

The Metropolitan Electric Cable and Construction Co., Ltd., is repeating last year's interim dividend of 2½ per cent.

The Watford Electric & Manufacturing Co., Ltd., announces an interim dividend of 5 per cent. (same).

New Companies

Sargrove Electronics, Ltd.—Private company. Registered September 7th. Capital, £100. Objects: To acquire from J. A. Sargrove the benefit of existing and future inventions, and to carry on the business of electronics, radio, electrical, plastic, mechanical, scientific and general engineers, etc. Directors: W. J. Nobbs, East End, Seale, near Farnham, Surrey, and J. A. Sargrove, Willow Dene, Dockett Eddy, Shepperton-on-Thames. Registered office: 25, Ferry Road, Teddington, Middlesex.

Watson-Ultratone Co., Ltd.—Private company. Registered September 23rd. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, electrical appliances and accessories, electrical, motor and general

engineers, etc. Directors: R. B. Watson, 47, Belle Vue Road, Shrewsbury, and H. Sheldon, Admiral Benbow Hotel, Swan Hill, Shrewsbury. Registered office: 47, Belle Vue Road, Shrewsbury, Salop.

Bernards Electrical Industries, Ltd.—Private company. Registered September 21st. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, accumulators, dry cell and other batteries, acids and containers, owners of charging and repairing stations, manufacturing chemists, wireless and electrical dealers, electricians, etc. Directors: B. Goodhead and C. B. J. Goodhead, both of 99, Kingsley Road, Hounslow. Secretary: G. B. T. Goodhead. Registered office: 99, Kingsley Road, Hounslow, Middlesex.

Radio Laboratories (Penzance), Ltd.—Private company. Registered September 27th. Capital, £1,000. Objects: To acquire the business of radio maintenance and service engineers carried on by A. A. J. Crowne and J. G. Crowne, at 29, Market Jew Street, Penzance. Directors: A. A. J. Crowne and Joan G. Crowne, both of 7, Regent Terrace, Penzance. Registered office: 29, Market Jew Street, Penzance, Cornwall.

H. M. Walters & Co., Ltd.—Private company. Registered September 22nd. Capital £3,000. Objects: To acquire the business of manufacturing electrical engineers carried on by A. W. Webb and A. Reynolds at Diceland Works, Banstead, Surrey, as H. M. Walters & Co. Directors: A. W. Webb, Lone Pine, Salisbury Road, Banstead, Surrey, and A. Reynolds, 11, Copse Hill, S.W.20.

Melville Thomas, Ltd.—Private company. Registered September 28th. Capital, £1,000. Objects: To carry on the business of welding engineers and consultants, manufacturers of, and dealers in, fluxes, mechanical, electrical, radio, motor, scientific and general engineers, etc. Subscribers: M. H. Thomas, 42, Woodfield Road, King's Heath, Birmingham, and W. L. Joberns, 71, Temple Row, Birmingham. Registered office: Hurst Mill, Pershore Road South, King's Norton, Birmingham.

Companies' Returns

Statements of Capital

Notting Hill Electric Lighting Co. Ltd.—Capital, £450,000 in 250,000 ordinary shares of £1 and 20,000 preference shares of £10 each. Return dated May 23rd, 1943. 135,250 ordinary and 20,000 preference shares taken up. £201,352 10s. paid (1s. on 27,050 ordinary and £10 on 20,000 preference shares). £133,897 10s. considered as paid (£1 on 108,200 ordinary and 19s. on 27,050 ordinary shares). Mortgages and charges: £127,050.

J. B. Saunders, Ltd.—Capital, £5,000 in £1 shares (4,000 ordinary and 1,000 preference). Return dated May 27th, 1943 (filed June 23rd, 1943). All shares taken up. £5,000 paid. Mortgages and charges: Nil.

City of Buenos Ayres Tramways Company (1904), Ltd.—Capital, £1,240,000 in 248,000 shares of £5 each. Return dated May 6th, 1943. All shares taken up. £1,240,000 considered as paid. Mortgages and charges: £91,674.

Gilbey Electrical Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1942 (filed May 18th, 1943). All shares taken up. £2 paid. £1,998 considered as paid. Mortgages and charges : Nil.

Albert Electric Co., Ltd.—Capital, £200 in £1 shares. Return dated April 5th, 1943 (filed June 5th, 1943). 50 shares taken up. £50 paid. Mortgages and charges: Nil.

Mortgages and Charges

E. Hammond & Co. (Auto-Electric), Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated September 14th, 1943, to secure £4,000. Holders: Len Hulme, Ltd., 40A, Ardwick Green, Manchester, 13.

Lancashire Cables, Ltd.—Satisfaction in full on July 30th, 1943, of deposit of deeds and debenture, registered December 8th, 1938, and April 6th, 1939, respectively, securing all moneys due or to become due from the company to Barclays Bank, Ltd.

Fusarc Welding Co., Ltd.—Satisfaction in full on September 6th, 1943, of mortgage and charge registered April 28th, 1942, and January 22nd, 1943, respectively.

Liquidations

Kolster-Brandes, Ltd.—We are asked to state that the notice under this heading in the *Electrical Review* of September 3rd (p. 320) related to the company which went into liquidation in May, 1938, and not to the present company of the same name.

Bankruptcies

R. Robinson, electrical engineer, The Arcade, Waterfoot, Lancs.—Supplemental dividend of 6s. in the £, payable October 19th at the Official Receiver's offices, 20, Byrom Street, Manchester, 3.

British Property in Enemy Countries

LIEUT.-COL. Lord Dudley Gordon, D.S.O., took the chair at the first meeting held recently of the F.B.I. committee formed to consider the subject of British property, rights and interests in enemy and enemy-occupied countries. Mr. C. F. I. Ramsden, Foreign Director of the F.B.I., said that the question was a much more complicated one than arose after the last war, when about £100,000,000 was obtained from the liquidation of German assets in this country and from transfers by Germany to this country, with the result that British claims were met in full and, in addition, a substantial sum handed over to the Treasury. British investments on the Continent were now far larger, while German assets in this country were likely to prove much smaller. Also, it should be borne in mind that the fact of the enemies' widespread occupation on the Continent and in the Far East added to the complexity of the problem.

The committee discussed the different sections into which the subject can be divided and agreed that it might be necessary to set up sub-committees to consider them.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK EXCHANGE markets continue to attract a substantial amount of daily business and prices exhibit such firmness as to imply that the buying predominates. The gilt-edged group has been fortified by a fair amount of investment in the 3½ per cent. War Loan, and the famine amongst gilt-edged industrial debenture stocks is as marked as ever. The front-rank ordinary shares are more easily sold than they are bought; the results shown in dividends and reports are on the whole decidedly satisfactory. The character of the war news is held to warrant the confidence which the public show in the outlook for stocks and shares.

London Power Co.

On the 20th of this month, the London Power Co. will draw £750,000 of its 5 per cent. redeemable debenture, at 100, for payment on December 31st next. The price has remained at 104½ for months, and out of the original amount of £17,000,000 stock, there will still be left £10¾ millions after redemption of the £750,000 mentioned above. The company has the right to redeem the whole or any part of the stock outstanding, at 100, on and after October 1st, 1952, upon giving three months' notice. Any stock outstanding on October 1st, 1972, will be paid off at 100. There is also 4, 3½ and a 3¼ per cent. redeemable debenture stocks. The share capital is £50,000 in £1 shares, carrying a fixed dividend of 6 per cent. per annum.

Interim Dividends

Various dividend announcements have made their appearance during the past few business days. Murex is to pay a final dividend of 10 per cent., and a cash bonus of 2½ per cent., on November 5th next. These are at the same rate as a year ago and make 20 per cent. for the year. The price of the shares at 5⅛ has recovered deduction of the dividend. The return on the money is a little under 4 per cent. The Cable & Wireless operating company has declared an interim dividend of 1½ per cent. for the fifth successive year; hitherto a final dividend of 2½ per cent. has been paid, making 4 per cent. for each year. At the same time, Marconi's Wireless Telegraph Co. declared its interim dividend of 3½ per cent., as usual, and Marconi Marine is again paying 2½ per cent. by way of interim dividend.

Four of the Edmundsons Electricity Corporation subsidiaries have announced repetitions of their last year's interim dividends. Another interim dividend is that of 3 per cent. from the Telephone & General Trust. Last year, there was a final of 5 per cent., making 8 per cent. for the year, and it is expected that this will be repeated in respect of the current period. The price of the £1 ordinary shares is 31s. 9d.

Price Fluctuations

Metal Industries at 45s. have followed up last week's rise of 1s. 9d. with a further gain of 1/16. Brush ordinary responded, with an improvement to 9s., to a good deal of buying induced by the latest developments. International Combustion at 6¼ are ⅛ higher. Amongst the few declines are Hopkinsons, 1s. 6d. down at 62s., Ever Ready at 40s. and, in the armament group, Vickers at 18s. 9d. ex dividend.

Brazilian Tractions rose $2 on declaration of a final dividend for the year of $1. Hopeful dividend anticipations were thereby fully satisfied. Argentine issues of all descriptions are showing strength. Anglo-Argentine Tramways debenture stocks participate in the harder tendency.

Communication Stocks

Cable & Wireless (Holding) 5½ per cent. preference stock has receded a point to 112, the ordinary remaining at 78. The chief changes in this group are rises to 38s. in Globe Telegraph & Trust ordinary and to 28s. 6d. in the Trust's 6 per cent. preference shares. Telephone Properties ordinary shares are better at 15s., on the expectation that they may shortly return to the dividend list; the last payment was made in May, 1940. Anglo-American Telegraph 6 per cent. preferred is 10s. lower at 115½. The Western Union Telegraph Co., which leases the Anglo-American, has acquired control of the United States land-lines system. This was effected by the Postal Telegraph Company's fusion with the Western Union.

Radio Shares

There has been a return to favour of radio shares and prices are mostly better. E. K. Cole have put on a florin, advancing to 27s., shares changed hands over 28s. Philco rallied to 15s. 3d. Last week's meeting produced no fresh information to add to the previously-circulated statement. Cossor shares have kept at about 24s. 6d. Buyers paid 28s. 6d. for Electric & Musical Industries, after which the price went back to 28s. Pye deferred still give the best yield in this group; the 25 per cent. dividend on the 5s. shares affords 5 per cent. at the present price of 25s.

Ferranti

The ordinary shares of Ferranti, Ltd., are all privately held, but in the 7 per cent. preference shares there is a Stock Exchange market, the price-basis being 29s. 6d., at which the yield on the money comes to 4¾ per cent. Dividends are paid on January 1st and July 1st. To pay 7 per cent. preference

(*Continued on page* 488)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend: Previous	Dividend: Last	Middle Price Oct. 5	Rise or Fall	Yield p.c. £	s.	d.
Home Electricity Companies							
Bournemouth and Poole ..	12½	12½	59/–	+1/6	4	9	0
British Power and Light	6	7	32/6	..	4	4	9
City of London ..	7	7	28/–	..	5	0	0
Clyde Valley ..	8	8	39/6	..	4	1	0
County of London	8	8	40/6	..	3	19	0
Edmundsons:							
7% Pref. ..	7	7	34/–	..	4	2	4
Ord.	6	6	28/6	..	4	4	3
Elec.Dis.Yorkshire	9	9	44/–	..	4	1	10
Elec. Fin. and Securities ..	12½	12½	53/–	..	4	14	4
Elec. Supply Corporation ..	10	10	45/6	..	4	8	0
Isle of Thanet ..	Nil	Nil	18/–	+6d.	—		
Lancs. Light and Power ..	7½	7½	34/6	..	4	7	0
Llanelly Elec. ..	5½	6	25/6	..	4	14	1
Lond.Assoc.Electric	4	3	23/6	..	2	11	0
London Electric	6	6	26/6	..	4	10	7
London Power Red. Deb.	5	5	104½	..	4	15	7
Metropolitan E.S.	8	8	41/–	..	3	18	0
Midland Counties	8	8	39/–xd	..	4	2	0
Mid. Elec. Power	9	9	42/6xd	..	4	4	9
Newcastle Elec...	7		31/–	..	4	10	5
North Eastern Elec.: Ordinary ..	7	7	32/6	..	4	16	2
7% Pref. ..	7	7	33/6	..	4	3	7
Northampton ..	10	10	47/6	..	4	4	0
Notting Hill 6% Pref. (£10) ..	6	Nil	10	..	—		
Northmet Power: Ordinary ..	7	7	38/–	..	3	13	8
6% Pref. ..	6	6	30/–	..	4	0	0
Richmond Elec. .	6	6	26/–	..	4	12	4
Scottish Power ..	8	8	38/–	..	4	4	4
Southern Areas	5	5	22/–	..	4	10	11
South London ..	7	7	26/6	..	5	5	8
West Devon ..	5	5	23/6	..	4	5	0
West Glos. ..	4½	3½	24/–	..	2	18	4
Yorkshire Elec. .	8	8	41/–	..	3	18	0
Overseas Electricity Companies							
Atlas Elec. ..	Nil	Nil	7/9	+1/3	—		
Calcutta Elec. ..	7*	6*	38/–	–1/–	3	3	2
Cawnpore Elec. .	10	10	34/6	..	5	16	0
East African Power	7	7	33/6	..	4	3	7
Jerusalem Elec.	7	5	30/6	..	3	5	7
Kalgoorlie (10/–)	5	5	10/–	..	5	0	0
Madras Elec. ..	4*	Nil	22/6	..	—		
Montreal Power	1½	1½	29	..	5	1	8
Palestine Elec."A"	4*	5*	42/–	..	2	7	8
Perak Hydro-elec.	6	7	14/–	..	—		
Shawinigan Power	83cts.	90cts.	19	..	—		
Tokyo Elec. 6%	6	6	23	–1	—		
VictoriaFallsPower	15	15	4½	..	3	9	7
Whitehall Inv.Pref.	—	—	25/–	..	4	0	0

Company	Dividend: Previous	Dividend: Last	Middle Price Oct. 5	Rise or Fall	Yield p.c. £	s.	d.
Public Boards							
Central Electricity:							
1955–60 (Civil Defence) ..	—	3	99½	..	3	0	4
1955–75 ..	5	5	113½	..	4	8	0
1951–73 ..	4½	4½	107	..	4	4	1
1963–93 ..	3½	3½	102	..	3	8	8
1974–94 ..	3½	3¼	99	–1	3	5	8
LondonElec.Trans. Ltd.	2½	2½	97	..	2	11	3
London & Home Counties 1955–75	4½	4½	111	..	4	1	1
Lond.Pass.Trans.:							
A	4½	4½	115½	..	3	18	0
B	5	5	115½	..	4	6	7
C	2⅞	3	69	..	4	7	0
WestMidlandsJ.E.A. 1948–68 ..	5	5	109	..	4	11	9
Telegraph and Telephone							
Anglo-Am. Tel.:							
Pref.	6	6	115½	–½	5	4	0
Def.	1½	1½	27½	..	5	9	1
Anglo-Portuguese	8	8	24/–	..	6	13	4
Cable & Wireless:							
5½ Pref. ..	5½	5½	112	–1	4	18	3
Ord.	4	4	78	..	5	2	7
CanadianMarconi	$1 Nil	4cts.	9/6	..	—		
Globe Tel. & Tel.:							
Ord.	8¼*	5*	38/–	+1/–	2	12	8
Pref.	6	6	28/6	+6d.	4	4	3
Great NorthernTel. (£10)	Nil	Nil	23	..	—		
Inter. Tel. & Tel.	Nil	Nil	17	..	—		
Marconi-Marine..	7½	7½	32/9	..	4	11	7
Oriental Tel. Ord.	16	10	45/–	..	—		
Telephone Props.	6	Nil	15/–	+6d.	—		
Tele.Rentals (5/–)	10	10	11/–	..	4	11	0
Traction and Transport							
Anglo-Arg.Trans.:							
First Pref. (£5)	Nil	Nil	3/6	..	—		*
4% Inc. ..	Nil	Nil	12	+1	—		
Brit.Elec.Traction:							
Def. Ord. ..	45	45	1125	..	4	0	0
Pref. Ord. ..	8	8	175	..	4	11	5
Bristol Trams ..	10	10	52/–	+1/–	3	17	0
Brazil Traction ..	$1	$1⅛	31½	+2	—		
Calcutta Trams..	5½	6½	41/–	..	3	3	5
Cape Elec. Trams	5	6	24/–	..	5	0	0
Lancs. Transport	10	10	44/3xd	+6d.	4	10	4
Mexican Light:							
1st Bonds ..	5	5	107½	..	4	13	0
Rio 5% Bonds ..	5	5	105½	..	4	14	9
Southern Rly.:							
5% Prefd. ..	5	5	75½	..	6	12	4
5% Pref. ..	5	5	108	..	4	12	7
T. Tilling ..	10	10	57/–	+6d.	3	10	2
West Riding ..	10	10	43/–	..	4	13	0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Oct. 5	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron. Elec. Ord. .	7½	10	46/3	..	4 6 7
Assoc. Elec. :					
Ord.	10	10	51/–	..	3 18 6
Pref.	8	8	38/–	..	4 4 3
AutomaticTel.&Tel.	12½	12½	59/–	..	4 4 9
Babcock & Wilcox	11	11	47/3	+6d.	4 13 0
British Aluminium	10	10	47/–	–3d.	4 5 1
British Insul. Ord.	20	20	5 5/8	..	3 12 2
British Thermostat (5/–)	18½	18½	19/–	..	4 17 4
British Vac.Cleaner (5/–)	15	30	27/6	..	5 9 1
Brush Ord. (5/–)	6	8	9/–	+6d.	4 9 0
Burco (5/–) ..	15	15	15/9	..	4 15 3
Callender's ..	15	20	5½	..	3 18 2
ChlorideElec.Storage	15	15	82/6	..	3 13 0
Cole, E. K. (5/–)	7	10	27/–	+2/–	1 17 2
Consolidated Signal	17	24	5⅞	..	4 3 6
Cossor, A. C. (5/–)	7½*	10*	24/6	..	2 1 9
Crabtree (10/–) ..	17½	17½	39/–	..	4 9 9
Crompton Parkinson Ord. (5/–) ..	20	20	26/–	..	3 17 0
E.M.I. (10/–) ..	6	6	28/–	..	2 2 10
Elec.Construction	10	12½	50/–	..	5 0 0
Enfield Cable Ord.	12½	12½	58/–	..	4 6 2
English Electric. .	10	10	48/–	..	4 3 4
EnsignLamps(5/–)	25	25	22/6	..	5 11 1
Ericsson Tel. (5/–)	22*	20*	53/–	..	1 17 9
Ever Ready (5/–)	40	40	40/–	–6d.	5 0 0
Falk Stadelmann	7½	7½	32/–	..	4 13 9
Ferranti Pref. ..	7	7	29/6	..	4 15 0
G.E.C. : Pref. ..	6½	6½	32/–	..	4 1 3
„ Ord. ..	17½	17½	91/–	..	3 17 0
Greenwood&Batley	15	15	42/6	..	7 1 2
HallTelephone(10/–)	12½	12½	25/6	..	4 18 0
Henley's (5/–) ..	20	20	25/–	..	4 0 0
4½% Pref. ..	4½	4½	23/–	..	3 18 3
Hopkinsons ..	15	17½	62/–	–1/6	5 13 0
India Rubber Pref.	5½	5½	21/6	..	5 2 4
Intl. Combustion	30	30	6½	+½	4 12 0
Johnson & Phillips	15	15	70/–	..	4 5 9
LancashireDynamo	20	22½	92/9	..	4 17 0
Laurence,Scott(5/–)	15	12½	12/–	..	5 4 2
London Elec.Wire	7½	7½	32/6	..	4 12 3
Mather & Platt ..	10	10	52/6	..	3 16 0
Metal Industries(B)	5	8	45/–	+1/3	3 11 2
Met.Elec.CablePref.	5½	5½	21/3	..	5 5 6
Murex	20	20	5½xd	+ 1/8	3 18 0
Pye Deferred (5/–)	25	25	25/–	..	5 0 0
Revo (10/–) ..	17½	17½	40/–	..	4 7 6
Reyrolle ..	12½	12½	70/–	..	3 11 5
Siemens Ord. ..	7½	7½	35/3	–3d.	4 5 1
Strand Elec. (5/–)	4	7½	7/3	..	5 3 5
Switchgear&Cowans (5/–) ..	10	20	18/–	..	5 11 1
T.C.C. (10/–) ..	5	5	20/–	..	2 10 0
T.C. & M. ..	10	10	53/–	..	3 15 6
TelephoneMfg.(5/–)	9	9	12/–	..	3 15 0
Thorn Elec. (5/–)	20	20	21/9	..	4 12 0
Tube Investments	20	20	93/–	..	4 6 2
Vactric (5/–) ..	Nil	Nil	13/9	..	—
Vickers (10/–) ..	10	10	18/9xd	–6d.	5 6 7
WalsallConduits(4/–)	55	55	44/–	..	5 0 0
Ward & Goldstone (5/–)	20	20	26/–	..	3 17 0
WestinghouseBrake	10	12½	66/3	..	3 15 6
West, Allen (5/–)	7½	7½	7/3	..	5 3 5

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 488)

dividend requires £35,000 gross per annum and for the year ended June, 1942, the profit, after payment of the preference dividend, was £28,467, comparing with £44,300 in the previous year and in 1939, and with £43,000 in 1940. For years past the company has paid an annual dividend of 6 per cent. on the ordinary shares, tax free as regards the last four years. In the company's balance sheet, goodwill figures at £1. Last July the directors were authorised to "raise or borrow or secure payment of" any sum for the purposes of the company not exceeding £3,000,000.

Atlas Electric

Since the beginning of this year, the price of Atlas Electric has come up from 4s. 6d. to the present 7s. 9d., and, as mentioned here, there was a rumour that the company had in prospect an opportunity for disposing of its Montevideo Tramway interest. For years past, the Montevideo Co. was held to be a white elephant: the Atlas Electric & General Trust owns its entire share and debenture capital. The gross receipts for 1942 showed an increase on the year. In addition to this Montevideo investment, the last issued balance sheet gave the value of Atlas investments as £5,763,000. The year ends with March, and the report appears as a rule in September. At the September 1942 meeting, the chairman said he feared that the Trust's revenue would suffer somewhat as a result of Japanese invasion of the Far East, while the support given by the company to the Government by subscribing to War Loans, curtailed the average rate of earnings. The share capital of the company is £6,000,000 of which £3,000,000 is in ordinary shares of £1 each. The price of the ordinary fell to 1s. in 1940 and was highest in 1937, when it reached 9s. 9d.

Nigerian Electricity

The Nigerian Electricity Supply Co. has declared a final dividend of 5 per cent., making 8 per cent. for the year ended February 28th last. For the year 1938-1939 the dividend was 3½ per cent., and the company distributed a capital bonus of 10 per cent. in ordinary shares. The ordinary received no dividend for the following year, but 8 per cent. in each of the next two. The tin mines are substantially the only consumers of the company's electricity, anything outside the mines being very small. The present price of the shares is 25s. which, with an 8 per cent. dividend, gives a yield of 5¾ per cent.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AILMÄNNA Svenska Elektriska Aktiebolaget.—"Automatic regulator using transductors or DC saturated inductances." 7169/42. June 9th, 1941. (555958.)

H. A. Brassert & Co., and R. Nissim.—"Electric arc furnaces." 1603. February 6th, 1942. (555978.)

British Thomson-Houston Co., Ltd.—"Electric supply systems for loads capable of regenerative operation." 5448/42. April 25th, 1941. (555954.) "Resistance welding apparatus." 14062/42. October 8th, 1941. (555963.) "Electrical control systems for maintaining predetermined speed relationships between co-operating electric motors." 4084/42. March 29th, 1941. (556016.) "Amplifying systems." 6940/42. May 22nd, 1941. (556051.) "Washing machines." 3256/42. March 13th, 1941. (556078.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—"Protective systems for alternating current circuits and apparatus therefor." 3857. March 23rd, 1942. (556014.) "Electronic-discharge devices such as X-ray tubes." 7694. June 5th, 1942. (556031.) "Frequency monitoring systems." 9395. July 7th, 1942. (556057.)

J. C. Chaston, H. W. Webb and Johnson, Matthey & Co., Ltd.—"Electrodes." 3433. March 16th, 1942. (556083.)

Constructors, Ltd., and W. C. Scrivener.—"Radio antennæ." 8556. June 22nd, 1942. (556055.) "Radio antennæ." 10242/43. June 22nd, 1942. (Divided out of 556055.) (556067.)

A. C. Cossor, Ltd., and H. Moss.—"Electron guns, such as are used in cathode-ray tubes." 3389. March 14th, 1942. (556046.)

Ferranti, Ltd., and J. Prince.—"Induction-type electricity meters." 6481. May 13th, 1942. (555956.)

General Electric Co., Ltd., and C. H. Marshall.—"Apparatus for tipping railway wagons and the like." 3604. March 18th, 1942. (556091.)

Manufacturing R.A.P. Ltd., and J. F. Gowar.—"Apparatus for testing the signal-to-noise ratio of electrical apparatus." 9343. July 6th, 1942. (555959.)

A. G. Mapp.—"Electrical measuring instruments." 704. January 16th, 1942. (556073.)

Marconi's Wireless Telegraph Co., Ltd., C. S. Cockerell, J. D. Brailsford and M. H. Cufflin.—"Radio directional receivers." 11624/41. February 23rd, 1940. (Divided out of 552497.) (555968.)

G. D. Mitchell.—"Variable reactance or choke coils." 9530. July 9th, 1942. (555960.)

Plessey Co., Ltd.—"Electrolytic condensers." 15012/42. February 10th, 1942. (555964.)

H. B. Prentice and J. G. Fielding.—"Double-break contact switches." 6489. May 13th, 1942. (556027.)

M. Raht.—"Method of covering electrical components such as condensers with an insulating coating." 4547. April 7th, 1942. (556094.) "Insulating envelope, particularly for electric condensers and method for making the same." 4548. April 7th, 1942. (556095.)

A. Reyrolle & Co., Ltd., and J. W. Bayles.—"Electric generators." 3313. March 13th, 1942. (555997.)

Stackpole Carbon Co.—"Electrical generator output regulator." 1834/42. February 11th, 1941. (556074.)

Standard Telephones & Cables, Ltd.—"High-frequency amplifier." 8436/42. June 21st, 1941. (556054.) "Radio antennæ." 4478/42. April 9th, 1941. (556093.)

Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.).—"Telephone and light signalling systems." 12137. August 28th, 1942. (556066.)

Standard Telephones & Cables, Ltd., and R. Stansfield.—"Means for detecting and measuring torsional vibrations." 3132. March 10th, 1942. (555943.)

Standard Telephones & Cables, Ltd., and W. J. L. Wildbore.—"Process and apparatus for winding wire strands, particularly for use in lapping or grading machines." 3259. March 12th, 1942. (555990.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and D. M. Ambrose.—"Electrical communication systems." 3374. March 13th, 1942. (556001.)

Standard Telephones & Cables, Ltd., P. K. Chatterjea and L. W. Houghton.—"Radio communication systems." 3294. March 12th, 1942. (555993.) "Multi-channel electrical communication systems." 3295. March 12th, 1942. (556079.) "Multi-channel carrier communication systems." 3375. March 13th, 1942. (556081.)

Standard Telephones & Cables, Ltd., G. C. Hartley and W. J. Reynolds.—"Electric code signalling systems." 3335. March 13th, 1942. (555999.)

Standard Telephones & Cables, Ltd., A. H. Roche and H. G. Kidner.—"Thermionic feedback amplifiers." 3131. March 10th, 1942. (555942.)

A. H. Stevens (Electronic Laboratories, Inc.).—"Electrical systems for converting direct current into alternating current." 3620. March 18th, 1942. (556092.)

Sulzer Fréres Soc. Anon.—"Water-tube steam generators." 3134/42. April 10th, 1941. 555945.)

L. J. Swift.—"Method of constructing basic linings for electric and other high-temperature furnaces." 4624. April 8th, 1942. (556048.)

Westinghouse Electric International Co.—"Electric circuit-breakers adapted for automatic reclosure." 11096/42. September 15th, 1941. (556063.)

Whipp & Bourne, Ltd., and I. T. L. Whipp.—"Electrical remote control systems." 391/42. January 7th, 1943. (556041.)

C. C. Wood.—"Electrodes used in the electrolytic production and/or for deposition of metals and metallic compounds." 123/42. February 5th, 1943. (555973.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—COMMONWEALTH.—P.M.G.'s Department. October 21st. Lamps and sockets. Sch. C.4196.

NEW SOUTH WALES.—Sydney County Council. November 25th. Automatic voltage regulating equipment for generator No. 10, at Bunnerong power station. Spec. 666, Comptroller of Stores.

Orders Placed

Australia.—The following acceptances of tenders have been recorded in *Tenders* (Melbourne):—

COMMONWEALTH.—Department of Supply and Shipping. Reflectors, Sch. 4268 (£707); clips, insulator pins, etc., Con. 4275 (£576); and buzzers, insulators, etc., Sch. 5142 (£245 and £1,068).—British G.E.C. Pty., Ltd. Cables, Con. 4667 (£874) and bare copper, Con. 5120 (£1,306).—British Insulated Cables, Ltd. Panels and clips, etc., Con. 3994/1 (£223).—Siemens (Aust.) Pty., Ltd.

Hertfordshire.—County Council. Accepted for Wellhouse Hospital, Barnet:—Switchboard, capable of taking 100 lines, 63 lines to be installed at once, additional telephones to be added as necessary, and maintenance of switchboard, wiring and instruments.—Ericsson Telephones.

London.—ST. PANCRAS.—Electricity Committee. Accepted. Meter testing battery (£78). —Chloride Electrical Storage Co. Spares for coal plant (£202).—International Combustion.

Southgate.—Emergency Committee. Accepted. Electrical work at wardens' posts (£69).—Northmet Power Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Residential country school for city scholars, Auchernach, Strathdon; T. F. Henderson, city engineer, Town House.

Amble.—Rebuilding cinema destroyed by fire; P. L. Browne, Son & Harding, Pearl Buildings, Newcastle-on-Tyne.

School canteen; R. & G. Brown, builders.

Bexhill.—Central kitchen, London Road; borough engineer.

Castle Donington.—Workers' houses for R.D.C.; W. Moss & Sons, Ltd., contractors, Queens Road, Loughborough.

Dumbarton.—Houses (50); burgh surveyor.

East Grinstead.—British Restaurant; U.D.C. surveyor.

Enfield.—Additions, Co-operative Laundry, Queensway; W. J. Reed, Architect's Department, C.W.S.

Fifeshire.—Houses and hostel; Fife Coal Co.

Gateshead.—Two wartime nurseries (£7,000). Contractors: W. Hall, Ltd., Gateshead and A. V. Clerey & Son, Sunderland.

Guildford.—Huts, Royal Surrey County Hospital, Farnham Road; governors.

Harrogate.—Infant welfare centre and school clinic; borough surveyor, Municipal Offices.

Ilford.—Shelters, Parkhill School (£1,140); Hammond & Miles.

Isle of Wight.—School canteens (£1,730), and report centre, West View (£2,000); county architect.

Leeds.—Temporary additions, Cookridge School (£1,000); city engineer.

London.—ST. PANCRAS.—Temporary church, Prince Albert Avenue; St. Mark's Church trustees.

Malton.—Houses for agricultural workers (£7,917) for R.D.C.; M. Booth & Son, builders, Bradford.

Middlesbrough.—New buildings for the Tees-side Bridge & Eng. Co., Ltd.; own architects.

North Riding.—Dining centres at Yarm and Normanby; county architect, County Hall, Northallerton.

North Shields.—Office and store, Reed Street, for Chisholm & Co.; R. Graham.

Northumberland.—Central kitchen at Shilbottle (£700); county architect, County Hall, Newcastle-on-Tyne.

Norwich.—Accommodation and apparatus for biochemical research, at Isolation Hospital; borough surveyor, City Hall.

South Shields.—Air raid shelter, Ocean Road School (£1,286); Henderson Bros., builders.

Office, Nile Street, for Smith's (Ironfounders), Ltd.

Stores, offices, etc., for John Readhead & Sons; L. J. Couves & Partners, architects, Carliol House, Newcastle-on-Tyne.

Additions to boiler shop at factory; Marshall, Tweedy & Bourn, architects, Grainger House, Newcastle-on-Tyne.

Two central kitchens; acting borough engineer.

Shelters at Baring Street School; Henderson Bros., Smith Street, Tyne Dock, South Shields.

Swindon.—Convalescent home, Cricklade; borough surveyor, Civic Offices.

Totnes.—Agricultural houses (16) for R.D.C.; W. G. Couldrey & Son, architects, 14, Palace Avenue, Paignton.

Tynemouth.—Office and store, Reed Street, for R. Graham; Chisholm & Co., builders, Upper Reed Street.

Additions to the Jubilee Restaurant (£1,000) and new restaurant on the Ridges Estate; borough engineer, 18, Howard Street, North Shields.

Store at Low Lights for Ogilvie, Ltd.; J. A. Whitelaw, builder, Tynemouth Road.